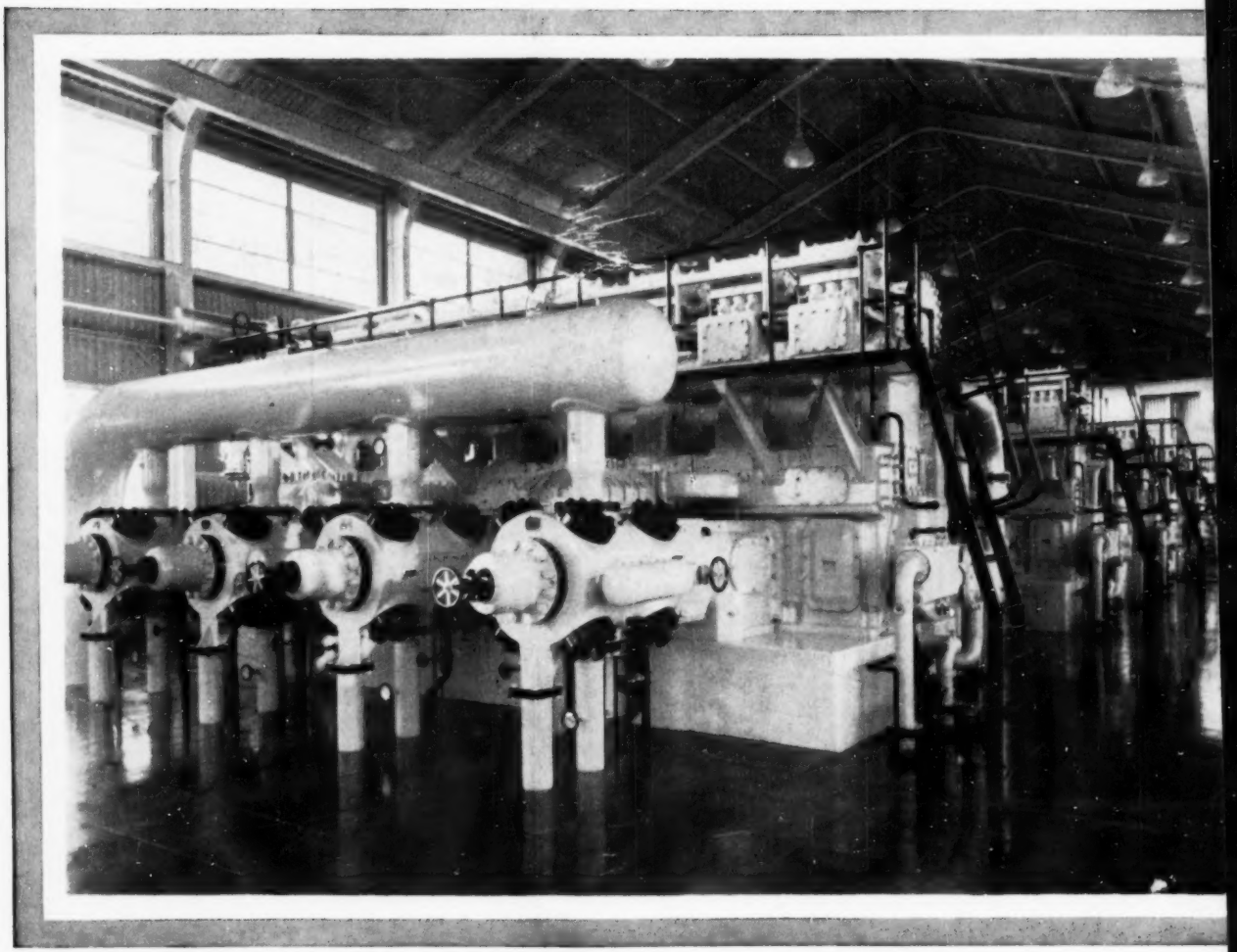
DIESEL POWER

AND DIESEL TRANSPORTATION

JUNE, 1953



- ***Gas Turbine-Electric Locomotives—A Progress Report***
- ***DeLaval's High-Pressure Turbocharger***

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El Paso Natural Gas Company reports satisfactory results with TEXACO URSA OIL P

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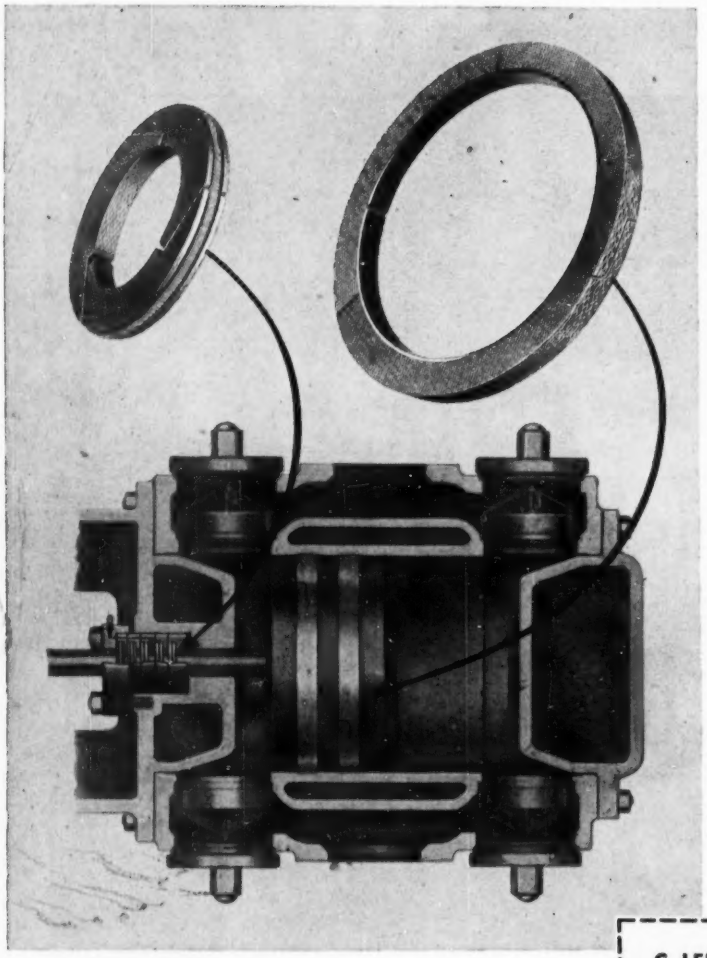

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British Representative
231, Strand,
London, W. C. 2, England

Subscription Rates

	Single Copies	1 year	2 years	3 years
U. S.	35¢	$3.00	$5.00	$ 6.00
Canada	40¢	4.00	7.00	9.00
Foreign	40¢	5.00	8.00	11.00

Diesel Power & Diesel Transportation is indexed regularly by Engineering Index, Inc. and is available in microfilm editions from University Microfilms, Inc., Ann Arbor, Michigan.

June, 1953

Vol. 31, No. 6

Cover Photo: McComb, Mississippi was the first compressor station to go into service in the United Gas Pipe Line Company's expansion program. Story starts on page 41.

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Diesel Publications, Inc., 192 Lexington Avenue, New York 16, N. Y.

DIESEL POWER and DIESEL TRANSPORTATION for June 1953, Vol. XXXI, No. 6. It is published monthly by Diesel Publications, Inc. Orange, Conn. Executive and Editorial offices at 192 Lexington Ave., New York 16, N. Y. Tel. MUrray Hill 3-9874. Entered as second class matter April 29, 1949 at the Post Office, Orange, Connecticut under Act of March 3, 1879.

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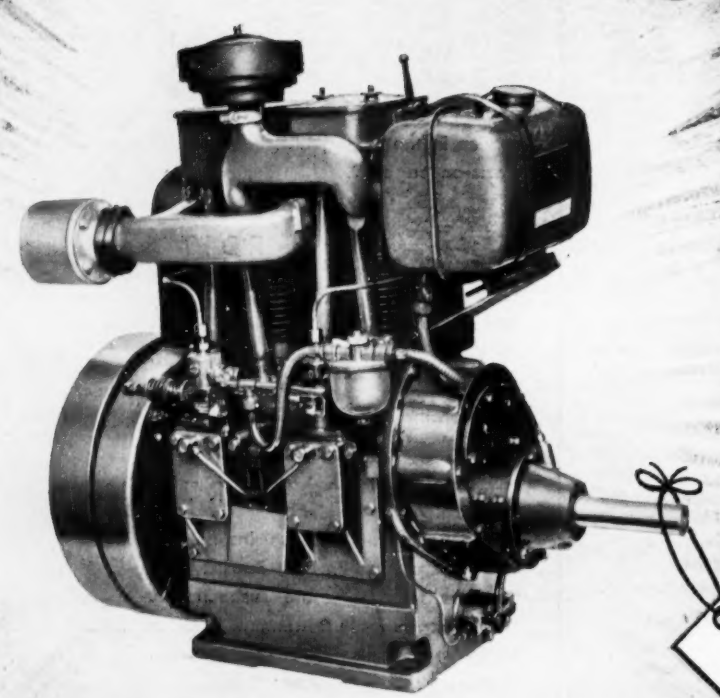

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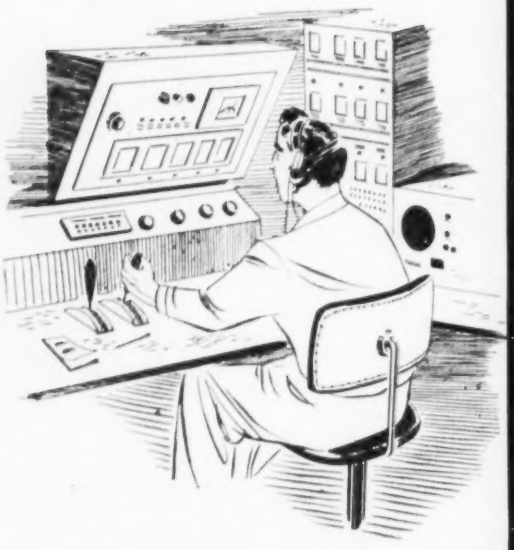

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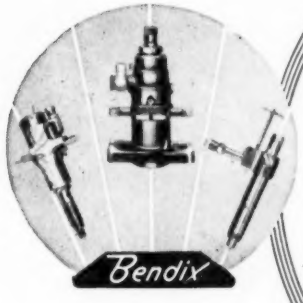

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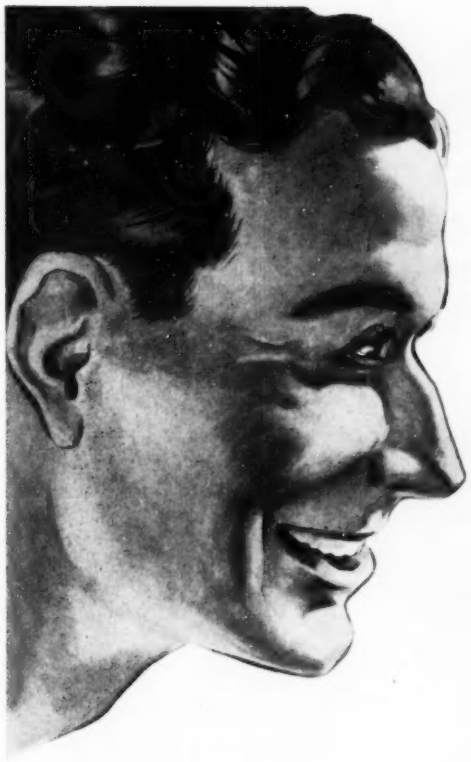

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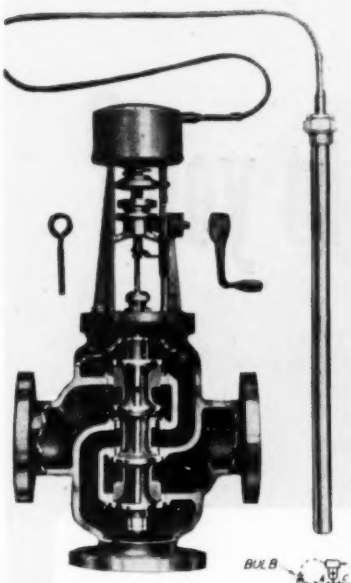

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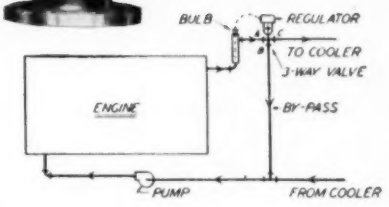

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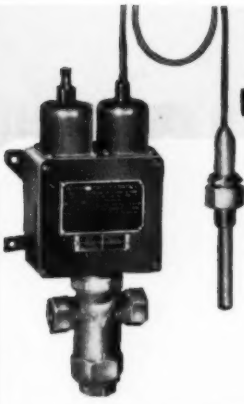

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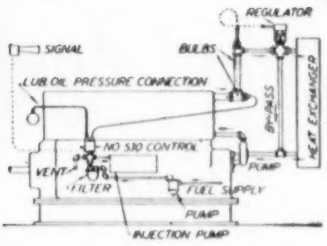

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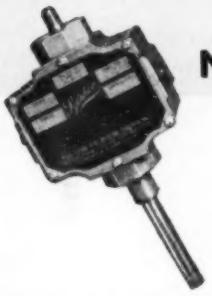

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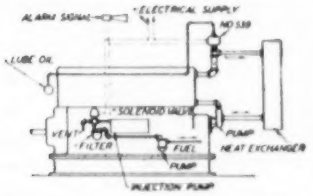

SOUNDS ALARM—*NO. 539 SYLPHON SAFETY CONTROL also protects against overheating or low lube oil pressure. If water jacket temperature goes above, or lube oil pressure goes below the safe point it sounds an alarm, flashes a warning light, or, if desired, shuts down engine operation. Fail-safe type.*

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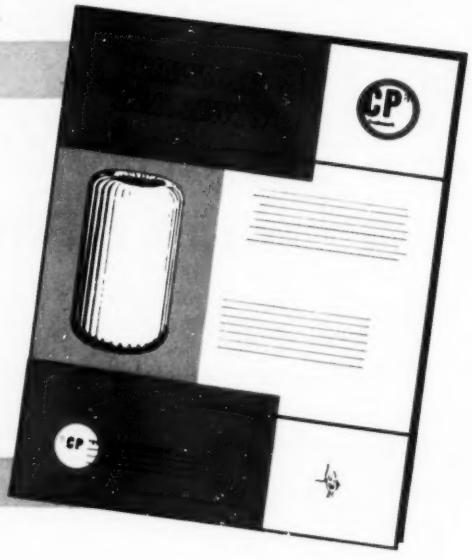

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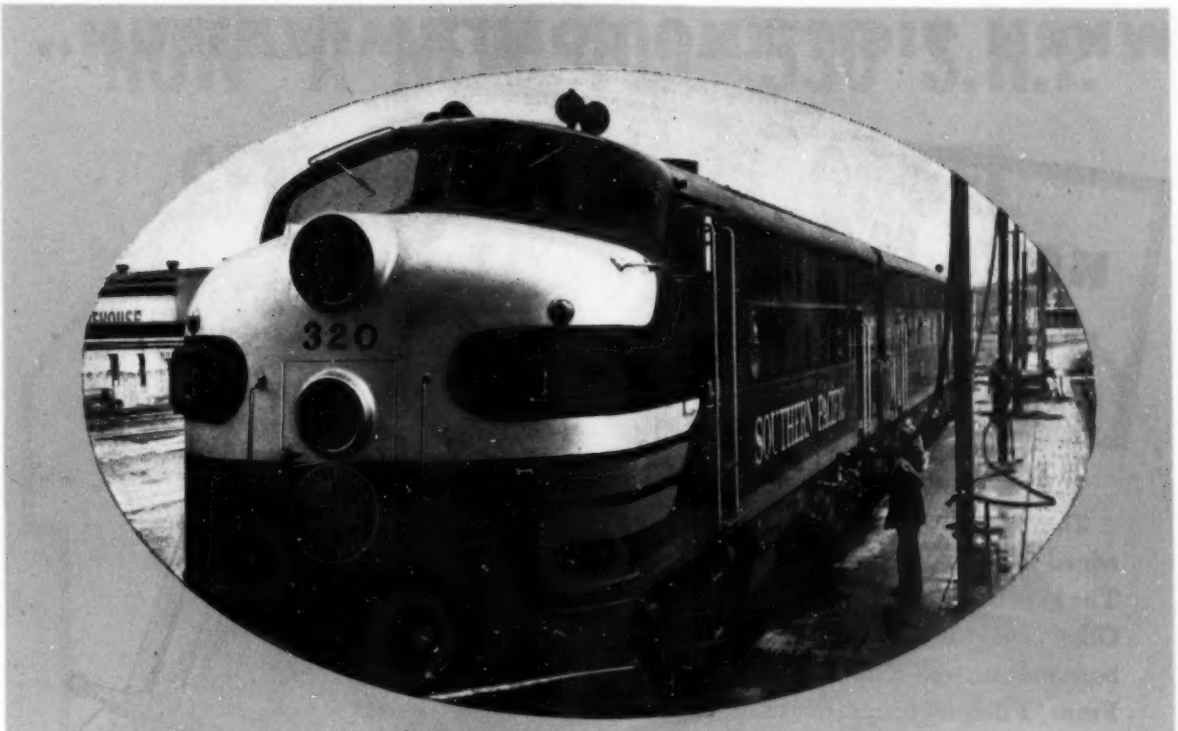

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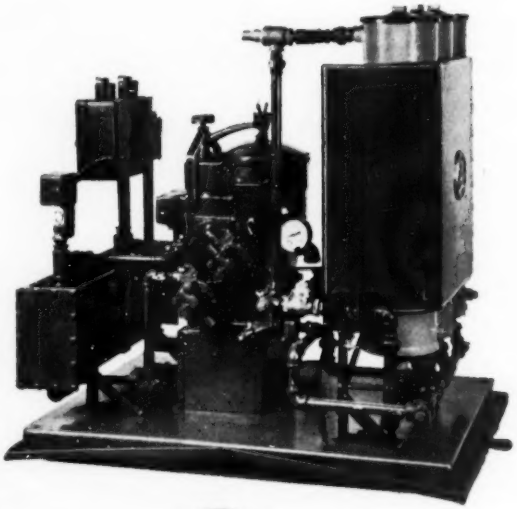

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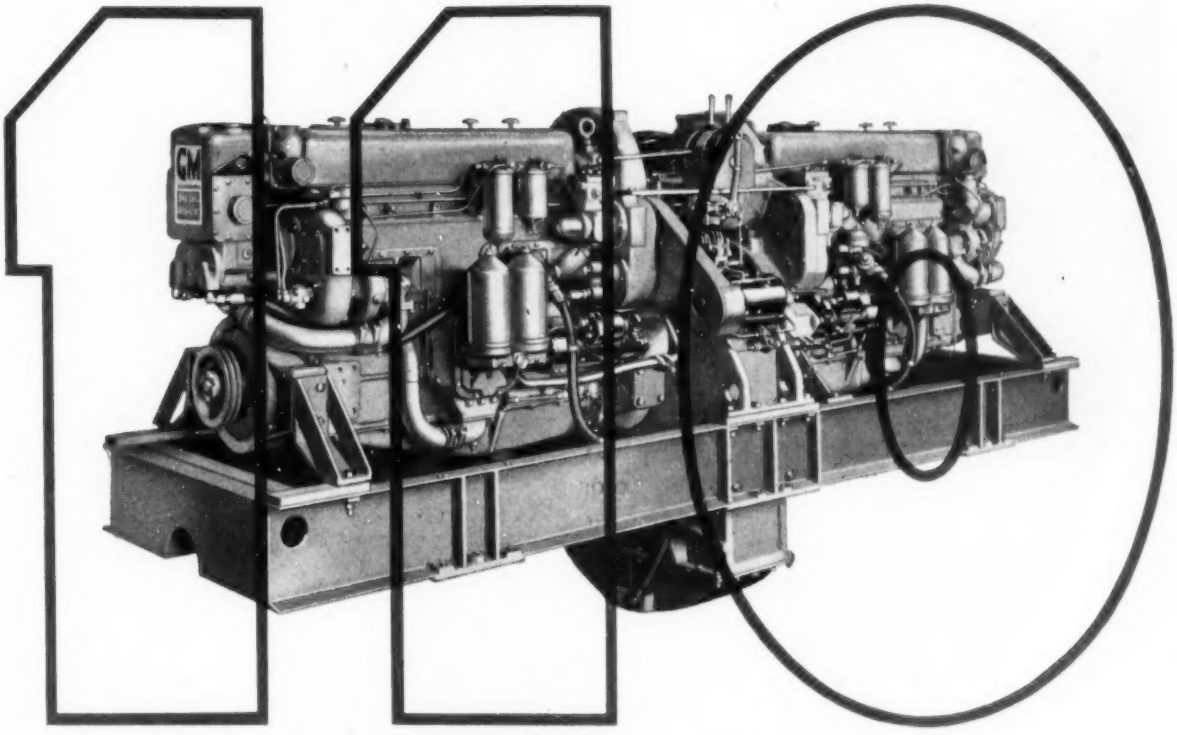
LUBRICATING OIL PURIFIERS

NOW—A NEW 409—530 S.H.P. GENERAL MOTORS DIESEL



The "110" Tandem Twin

★ ***409 Continuous Shaft Horsepower***

★ ***20% to 40% Lower Cost***

★ ***Twin Engine Dependability***

★ ***Clean, Compact Lines—Lighter Weight***

Meet the newest member of the General Motors Marine Diesel family—the power-packed "110" Tandem Twin.

Now you can have the *double dependability* of a more powerful GM Diesel Twin—530 horsepower for pleasure craft—a full 409 horsepower at the shaft for round-the-clock, heavy-duty work in tugs and fishing boats.

Like all GM Diesels, this new "110" Twin operates on the *2-cycle* principle—delivers smoother, steadier, more responsive power. It's more flexible, too, because you can shut off one of the engines when not needed. One engine running alone will propel a single-screw boat at 80% of its normal speed.

The slim, low silhouette of its tandem arrangement lets this unit fit in a smaller engine room, leaves more room, more space for fuel and pay load. And its clean, simple design, with ready accessibility for servicing, means easier, lower-cost maintenance. Its parts cost much less too.

But the big news is its low price. Here's a reserve of GM's time-proved Diesel power in a compact, lightweight marine unit that gives you the extra dependability and safety of twin engine operation—all at a price that's 20% to 40% less than any other Diesel of comparable power.

The new "110" Tandem Twin is available with port or starboard rotation; finger-tip GM hydraulic reversing; reduction gears up to 6:1; front power take-off for either engine and push-button electric starting. Your local GM Diesel distributor will gladly give you full details. Call him today, or write us for complete specifications.

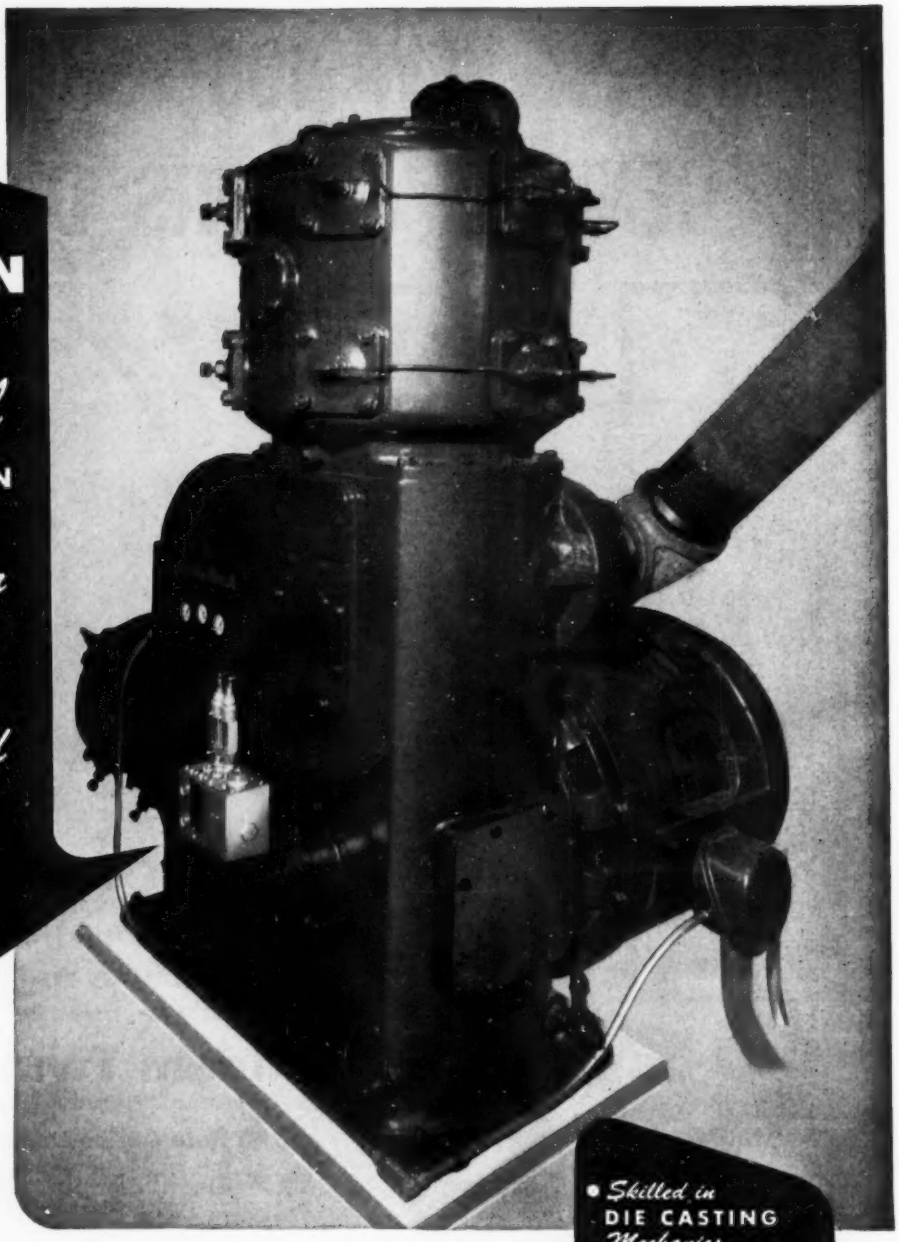
Single Engines . . . 16 to 275 H.P. Multiple Units . . . Up to 840 H.P.

GM DIESEL POWER

DETROIT DIESEL
ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN

MADISON -KIPP *fresh oil* LUBRICATION

fed under pressure by the measured drop!



Illustrated, the Madison-Kipp Model SVH Lubricator on an Ingersoll-Rand XLE Compressor.

- *Skilled in* DIE CASTING *Mechanics*
- *Originators of Really High Speed* AIR TOOLS
- *Experienced in* LUBRICATION *Engineering*

....STANDARD EQUIPMENT ON COMPRESSORS, WORK ENGINES AND MACHINE TOOLS....

Oil under pressure fed drop by drop from a Madison-Kipp Lubricator will definitely increase the production potential for years to come when applied as original equipment on new machine tools, work engines and compressors. There are six popular models for every application. Write for special engineering data for your particular requirement.

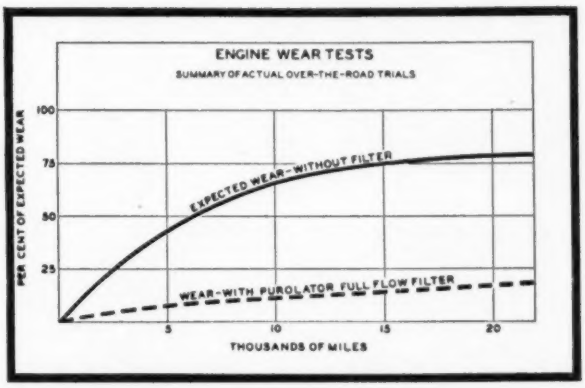
MADISON-KIPP CORPORATION

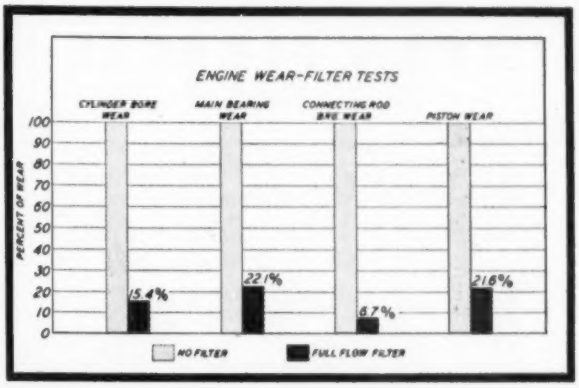
205 WAUBESA STREET, MADISON 10, WIS., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

Why leading automotive manufacturers say—





It's *Purolator** for Full-Flow!

In the charts above, you see summaries of important filter research programs, conducted independently by *two* of the world's largest automobile and truck manufacturers.

These were exhaustive investigations, taking several years to complete, in which virtually every available type and make of filter were tested.

What were the results? *Purolator filters out-performed all others by a significant margin.* In severe over-the-road tests of trucks and passenger cars, Purolator Full-Flow filters held engine wear to such an amazing minimum that often it was unmeasurable . . . while control vehicles *without* filters had to have complete engine overhauls.

In many other comparative tests, *conducted by vehicle and engine manufacturers themselves,* Purolator filters have been proved best . . . in fineness of filtration (.0000039 in.), in filtering area, in dirt storage capacity and in durability.

If you want further proof of Purolator's superiority, why not make your *own* tests . . . in your own way . . . under your own conditions? Purolator's Engineering Department will gladly co-operate in helping you adapt modern, super-efficient Purolator Full-Flow filtration to your own requirements.

*Reg. U. S. Pat. Off.

PUROLATOR PRODUCTS, INC.
Rahway, New Jersey and Toronto, Ontario, Canada
Factory Branch Offices: Chicago, Detroit, Los Angeles

PUROLATOR
WORLD'S FINEST OIL FILTER

FAIRCHILD POWER for the RYAN FIREBEE

JET POWER to send a remote-controlled, high-altitude missile streaking across the sky at near-sonic speeds called for a new concept in powerplant design.

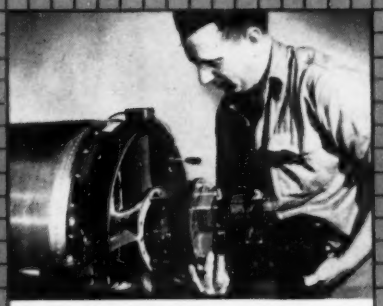
Fairchild met the challenge with the J-44 turbojet engine. It had to be extremely compact—yet provide more thrust than any engine of its size ever developed. It had to be expendable for warfare—yet quality-built for frequent re-use in research and training after parachute recovery.

In one application recently revealed, Fairchild's J-44 provides the power for the Firebee, a target drone with fighter plane performance, made by the Ryan Aeronautical Company.

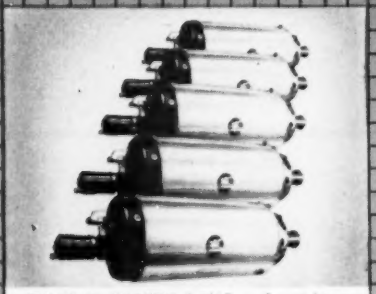
TIME WILL TELL of the expanding role in the nation's guided missiles program, in light aircraft and as a supplementary powerplant in large aircraft of this engine concept that *had to be different* . . . another example of the design, development and production facilities of Fairchild fulfilling specialized power requirements.

J-44 SPECIFICATIONS

Announced thrust	*1000 lbs*
Weight	*300 lbs*
Length	*72 inches*
Diameter	*22 inches*

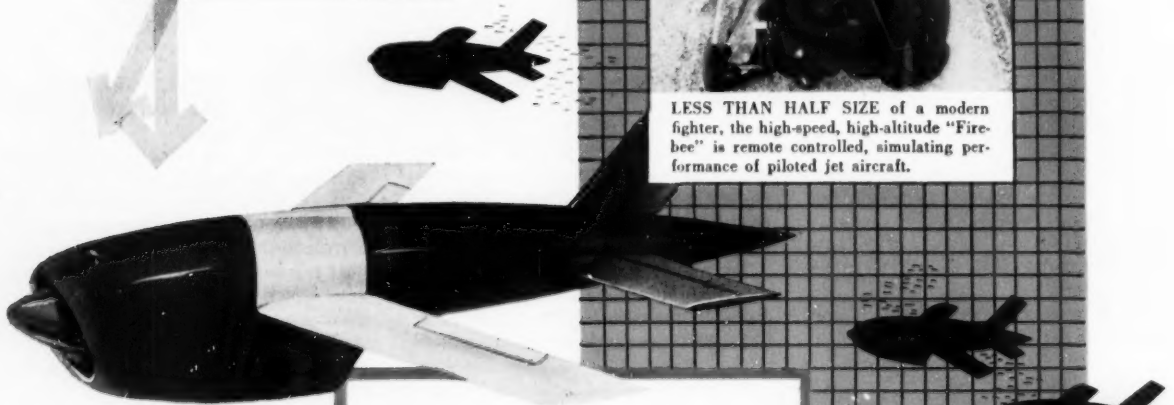


ACCESSORY SECTION containing essential controls, is quickly removed and replaced without special tools.



ONLY 72 INCHES LONG and weighing 300 pounds, the J-44 has varied applications in the nation's guided missiles program as well as in piloted aircraft.

LESS THAN HALF SIZE of a modern fighter, the high-speed, high-altitude "Firebee" is remote controlled, simulating performance of piloted jet aircraft.



ENGINE AND AIRPLANE CORPORATION

FAIRCHILD

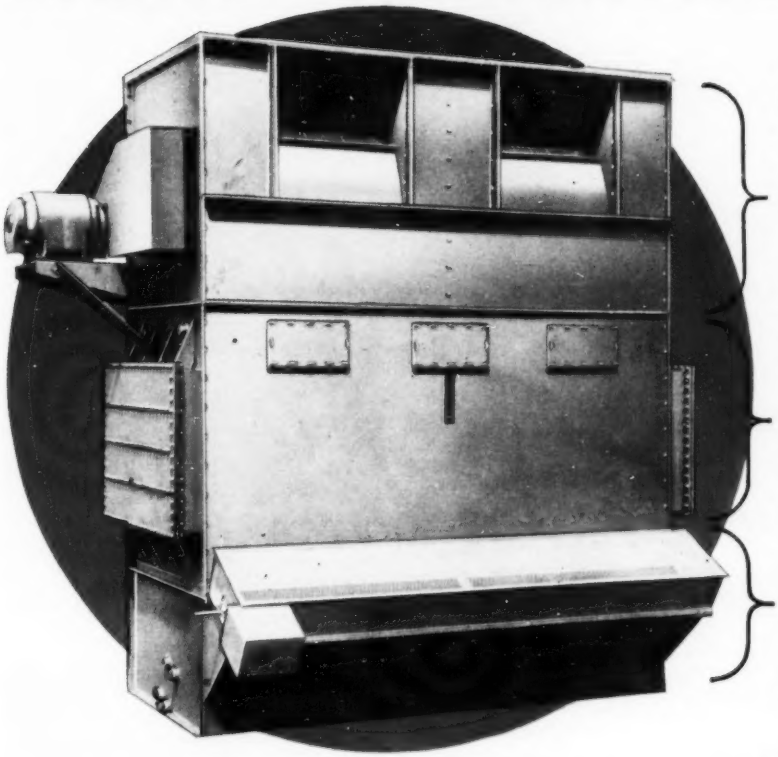
Engine Division

Farmingdale, L.I., N.Y.

Aircraft Division, Hagerstown, Md.

Guided Missiles Division, Wyandanch, L.I., N.Y.

Solve Big Cooling Problems with YOUNG EVAPORATIVE COOLERS



BLOWER SECTION

Built as a complete unit, this section consists of dynamically balanced multi-blade centrifugal blower, outlet scrolls for the blower housing, standard NEMA splash-proof motor, variable V-belt drive and air discharge duct. The blower fan is corrosion-resisting, double inlet design, dynamically balanced for long life, quiet operation.

COIL SECTION

Cooling coil section consists of straight, round, seamless tubes—copper, stainless steel or red brass—each rolled into header plates with baffles for multi-pass flow. Gasketed tank cover plates are used on coils for water and oil cooling. Tubes for cooling gases are rolled into steel tank headers with plugs opposite each tube for easy cleaning. Assembly also includes spray header, spray nozzles, moisture eliminators and inspection windows.

SUMP SECTION

The bottom, or sump section, consists of a water-tight, galvanized and rust-resistant reservoir for makeup and spray water, self-regulating float valve, and thermostatically controlled automatic shutters for the air inlet, air outlet, or both. The float valve automatically provides the volume of makeup water required to compensate for water losses due to evaporation and wastage.

Full length access door in sump tank for ease of service, and cleaning sump.

COOL— Jacket Water . . . Steam . . . Lube Oils . . . Natural Gas

For maximum heat transfer efficiency, select Young Evaporative Coolers to solve your big cooling problems. Versatile in design and completely self-contained, YEC units cool the liquid or gas in the coil by evaporation when water is sprayed over the coil assembly. Units are used primarily for cooling engine jacket water and lubricating oil (gas, gasoline, Diesel engines), steam, compressed air, natural gas or other fluids, and also for condensing steam, hydrocarbons, etc.

Designed and engineered to give long, efficient performance, Young Evaporative Coolers are built in six basic models, either with single or two coil assemblies. Normal operating pressures of 100 psig

CONDENSE— Hydrocarbons . . . Steam . . . Other Fluids

are used for water and oil cooling. However, for steam and natural gas cooling and condensing, pressures up to 2000 psig can be handled. Unit capacities range from 876,000 to 8,712,000 Btu's per hour.

Coil assemblies for water, oil and gas service consist of straight, round, seamless copper, stainless steel or red brass tubes, each rolled into thick header plates at each tank with multipass baffles. Oil cooling units use chain-type agitator strips inside the tubes to increase heat transfer. Straight Admiralty tubes in the Gas Cooler coil assembly are rolled into steel tanks with a plug opposite the end of each tube for easy cleaning. For special cooling jobs, call on a Young Representative, or write direct.

Young Quality

GET THIS NEW CATALOG!

Illustrated Catalog No. 1952 gives specifications, dimensions, capacities and features of YEC units.

YOUNG . . . AN "OLD" NAME IN HEAT TRANSFER ENGINEERING

YOUNG RADIATOR COMPANY

Dept. 413-F • Racine, Wisconsin • Factories at Racine, Wisconsin and Mattoon, Illinois

OPERATOR REPORTS

Production up — Maintenance down

Twenty of these Allison TORQMATIC-equipped trucks are working 21 hours a day hauling 34-ton pay loads of coal and overburden over 7½% grades.

The Wadesville Production Company operates 20 Allison TORQMATIC-equipped Euclid rear-dump trucks hauling 42,000 tons daily in its strip mine near St. Claire, Pa. These trucks boost production by making round trips 25% faster than the mechanical-drive units they replaced.

This operator's records show TORQMATIC DRIVES outlast mechanical drives — maintenance time and costs are down too. At routine overhaul periods, mechanics change out the TORQMATIC DRIVES in 2 hours less time than they change out a mechanical drive.

You, too, can cut your heavy-duty equipment operating costs by specifying Allison TORQMATIC DRIVES the next time you buy. Ask your equipment dealer, manufacturer or write:

ALLISON *Division of* GENERAL MOTORS
Box 894SS, Indianapolis 6, Indiana

ALLISON TORQMATIC DRIVES

Unbeatable Team for Maximum Operating Economy

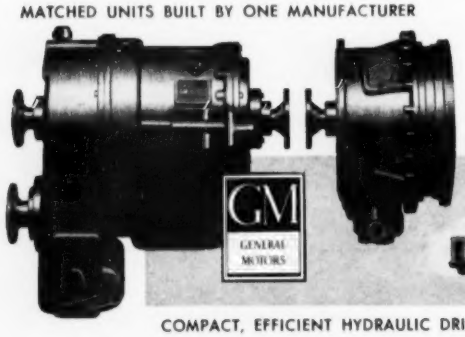
**Quick-shifts* at full throttle with finger-tip hydraulic control.

**Holds* power to load at all times — no clutch pedal to push—no gearshift guess.

**Cuts* maintenance cost by absorbing shock—eliminates engine lugging—prolongs equipment life.

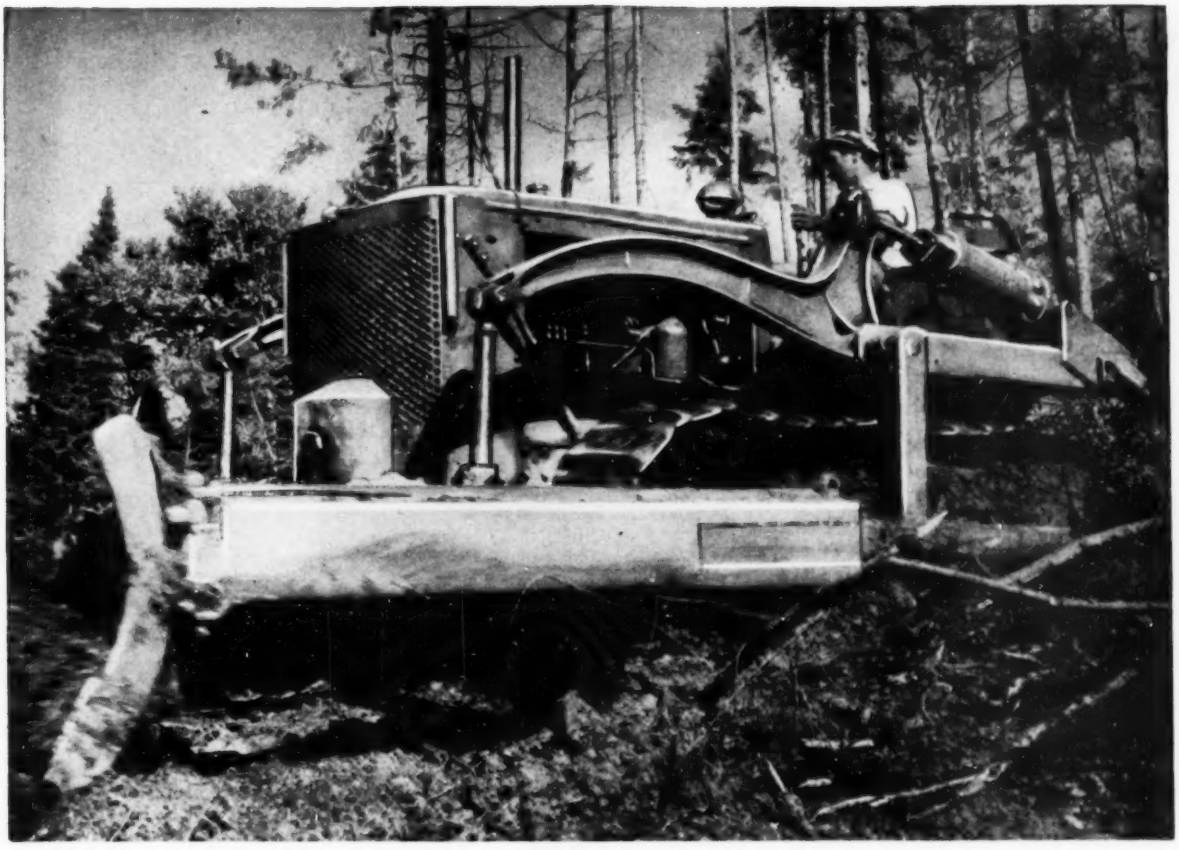
**Only* torque converter-transmission team designed to work as a unit and built by one manufacturer.

MATCHED UNITS BUILT BY ONE MANUFACTURER

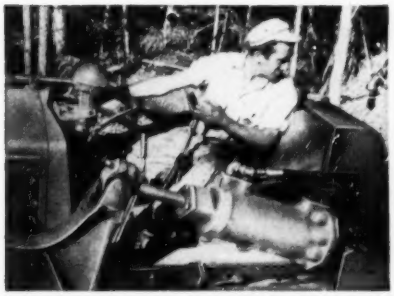


Allison TORQMATIC DRIVES

COMPACT, EFFICIENT HYDRAULIC DRIVES FOR CRANES * TRUCKS * TRACTORS * SHOVELS * SCRAPERS * DRILLING RIGS



BESIDES CUTTING OUT ROADS, Riendeau uses his TD 14 to push his truck and a 15-ton load through quagmire road sections.



RIENDEAU HANDLES BULLDOZER HIMSELF. He says: "I've had first-hand experience with the terrific performance these highest quality Cities Service Products deliver."

New Hampshire Logger Cuts Truck Roads Through Forest!

Oscar Riendeau of Berlin, N. H., has been hauling logs for about 15 years. To get his lumber out of densely overgrown New England forests, Riendeau has to cut his own truck roads. He carves out his twisting, turning truck roads with an International TD 14 Diesel . . . powered by Cities Service #2 Diesel Fuel! . . . lubricated with Cities Service Lubricants!

Says Riendeau: "I use Cities Service Products throughout my operation . . . diesel fuels, lubricants, gasolene, and even tires. These high quality, dependable products have kept my equipment at work full time under really rugged conditions. I heartily recommend them for any earth moving or trucking operation."

Why not try Cities Service Fuels and Lubricants in your operation?

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

P&H Diesel Engines

(2-CYCLE)

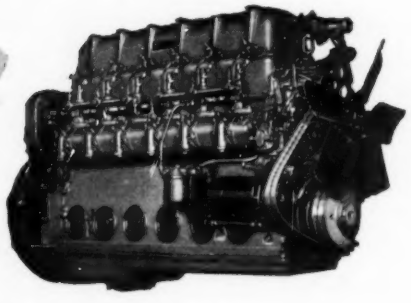
Do your diesels control temperature in this critical area?

Note the arrangement of intake ports on this unit cylinder head and liner assembly for a P&H Diesel. This entire area, including the spaces between ports, is fully water-jacketed to insure uniform cooling. No other 2-cycle diesel in this horsepower range controls temperatures throughout the entire stroke of the pistons!

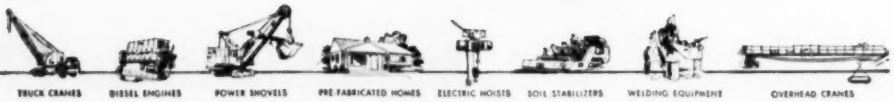
What does this mean to you? Lower temperatures give you greater protection against wear and tear — against parting of metals — against maintenance, repair and replacement problems.

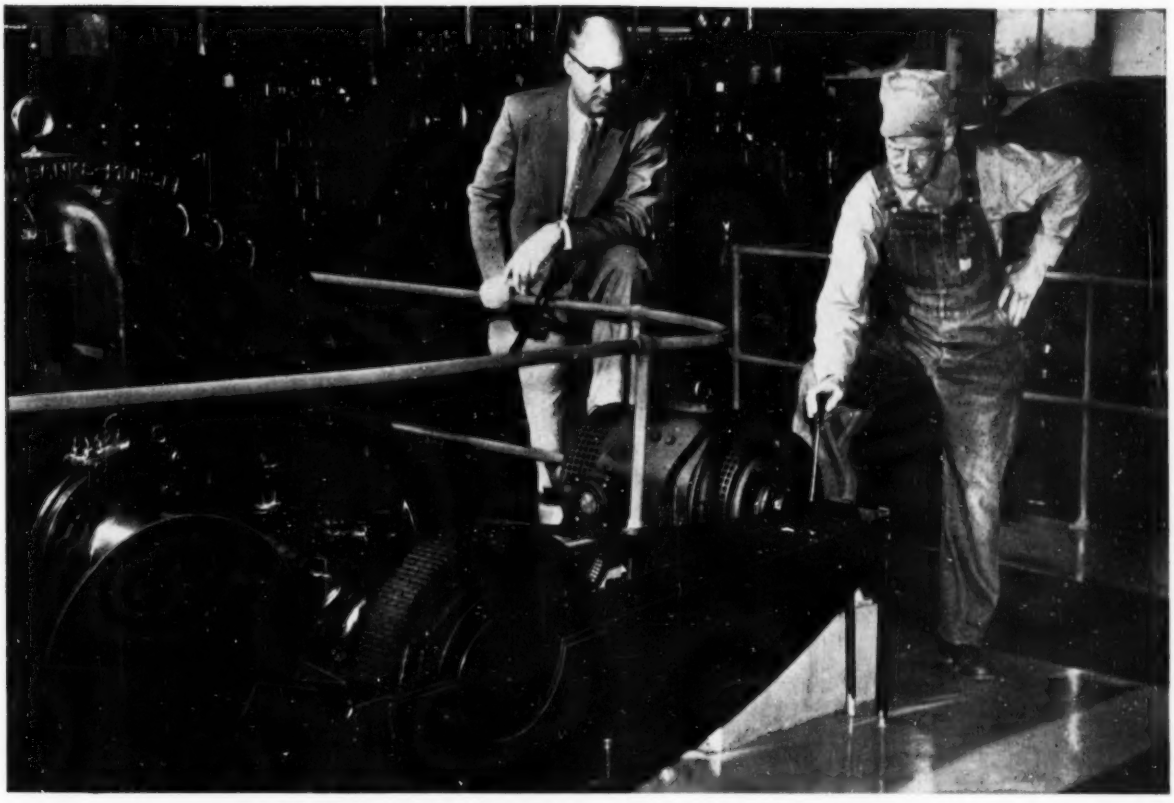
This is only one of many advantages you'll find in the advanced line of P&H Diesel Engines. They're available in 1, 2, 3, 4 and 6-cylinder models — from 20 to 138 h.p. Ask your nearest P&H Diesel representative for full details. Or write us.

P&H DIESEL DIVISION
HARNISCHFEGER CORPORATION
CRYSTAL LAKE, ILLINOIS



the P&H *Line*





Link-Belt Silent Chain Drive operates the exciter on this 840 kw Fairbanks-Morse generator in Kansas. Two other drives operate at 375 kw and 781 kw.

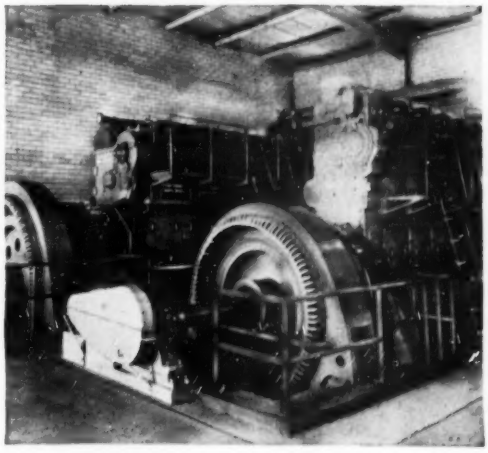
LINK-BELT Silent Chain Drives transmit full exciter rpm

Positive tooth-to-tooth action provides exact ratios for drives which give long, efficient service on diesel auxiliary drives

LINK-BELT Silverstreak Silent Chain does not rely on tension for its pulling power. The chain meshes with the sprocket teeth —gives you a positive drive—no slippage.

That's one big reason why so many diesel-generators have Link-Belt Silent Chain exciter drives. Another is its compact, all-metal construction. The long life of Silverstreak Silent Chain is a matter of record. Twenty-five years' service—with no maintenance other than routine lubrication—is regularly achieved.

If you're installing exciter or any other diesel auxiliary drives —check up on Link-Belt Silent Chain. There's an experienced power transmission engineer in the Link-Belt office near you.



At this Iowa station, the Link-Belt Silent Chain Exciter Drive transmits full rpm to a 1600 kw Elliot generator.

LINK-BELT

SILVERSTREAK SILENT CHAIN DRIVES

LINK-BELT COMPANY—Plants: Chicago, Indianapolis, Philadelphia, Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 12,000

ALCO DIESEL ENGINES

. . . dependable power for your purpose

Whatever your power requirements, you can depend on Alco Diesels.

You can depend on their high operating efficiency, their low long-run cost.

For Alco Diesels are designed and built with industry's needs in mind—and with the skill gained through many years of working closely with users of diesel engines the world over.

Applications for Alco Diesels are many. They include municipal power stations, oil pipeline pumping stations, marine power, and emergency stand-by service. They include, in fact, any application calling for an economical source of dependable diesel power.

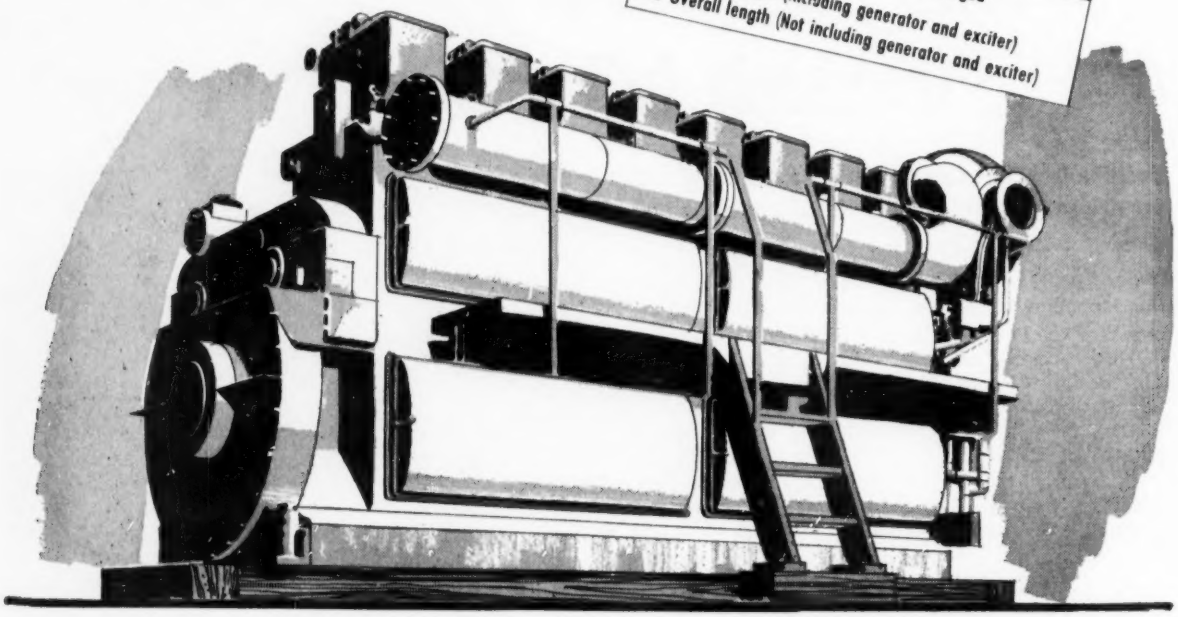
Your Alco sales representative will be happy to give you further information on Alco Diesels. You can contact him at Beaumont, Chicago, Cleveland, Houston, Kansas City, New York, San Francisco, Schenectady or St. Louis.

ALCO Engine Specifications

Type	6-12½x13		8-12½x13		*6-12½x13-T		*8-12½x13-T	
RPM	600	720	600	720	600	720	600	720
BHP	540	650	720	865	810	975	1080	1300
Bore	12½"		12½"		12½"		12½"	
Stroke	13"		13"		13"		13"	
A	20'-6½"		24'-9¼"		23'-6"		26'-8½"	
B	12'-11¾"		16'-8¼"		13'-4"		17'-3"	
Height	5'-0"		6'-8½"		5'-10½"		6'-1½"	
Width	20½"		21¼"		19½"		21"	

*Turbocharged

A. Overall length (Including generator and exciter)
B. Overall length (Not including generator and exciter)



ALCO DIESELS

AMERICAN LOCOMOTIVE COMPANY

SCHENECTADY, N. Y.

Alco

THE MARK OF MODERN ENGINEERING

Exide

XF HEAVY-DUTY BATTERIES

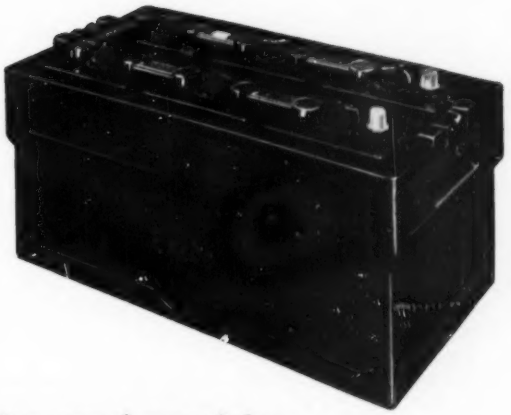
Way out in front for dependable performance and year-round economy. That's because the Exide XF is "Custom-engineered" for diesel starting. It's a product of years of progressive research-engineering . . . of intensive testing under severe operating conditions. The Exide XF battery offers

OUTSTANDING FEATURES:

New grid alloy • New active material—G.O.X.
Lower gravity electrolyte • New dual insulation

WITH EXIDE XF BATTERIES YOU GET:

EXTRA LONG LIFE—longer than you ever thought possible.
QUICK BREAKAWAY and fast acceleration of engine to firing speed.
RUGGED CONSTRUCTION for rough usage in hard service.
LOW COSTS of operation and maintenance.



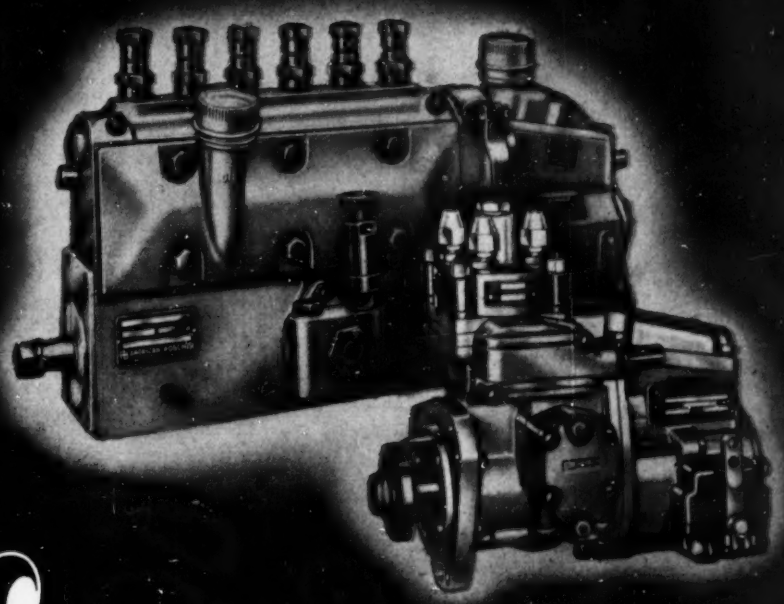
Now, more than ever before . . .
EXIDE IS YOUR BEST BATTERY BUY... *AT ANY PRICE!*

1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*
"EXIDE", *Reg. T.M. U.S. Pat. Off.*

If Power Failed—
HALF-WAY TO THE MOON
Synchro-Start CONTROLS
would automatically transfer the load to a stand-by power plant so they could carry on.
Your automatic engine installations do not have to be on "a rocket to the moon" to have this safe and economically controlled operation.
Twenty years of experience by the originators, in building and designing dependable automatic controls for internal combustion engine power plants, have proven SYNCHRO-START'S dependability.
Demand for stand-by power has grown to be a "must" with most all power users and SYNCHRO-START controls are the "brains" of their installations.
Ask your engine manufacturer—dealer—architect or write us for further information and nearest representative.
SYNCHRO-START PRODUCTS, INC.
8151 NORTH RIDGEWAY AVENUE, SKOKIE, ILLINOIS

AMERICAN BOSCH

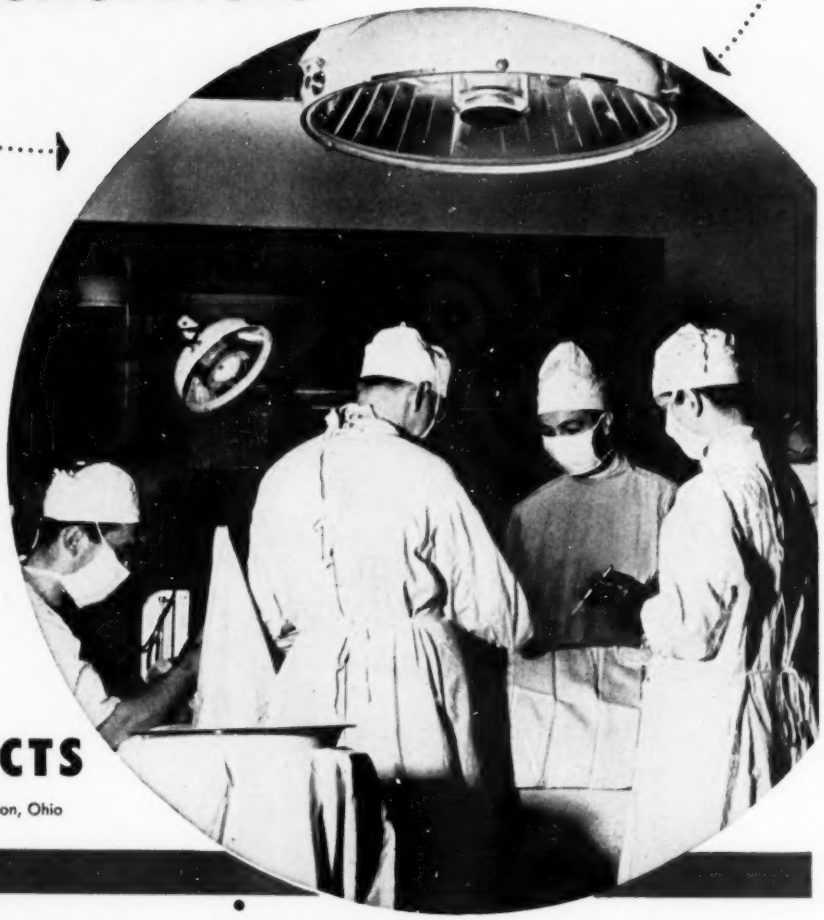


First in diesel fuel injection

First in the past, first today, first in the future . . . because American Bosch knows more about diesel fuel injection than any other manufacturer.

For stand-by power

Delco Generators



Delco generators are designed to serve Diesel power plants effectively . . . and without fail. With a power range of 20 kw through 200 kw, AC and DC, 1200, 1500, and 1800 rpm, Delco generators have kept pace with Diesel engineering.

Hospitals, schools, public buildings, carnivals, circuses and outside construction jobs frequently call for power from an independent source. At such times Delco generators, time and again, prove their dependability for stand-by or portable service. Any of the sales offices listed below will be glad to supply detailed information.

DELCO DAYTON OHIO

DELCO PRODUCTS

Division of General Motors Corporation, Dayton, Ohio

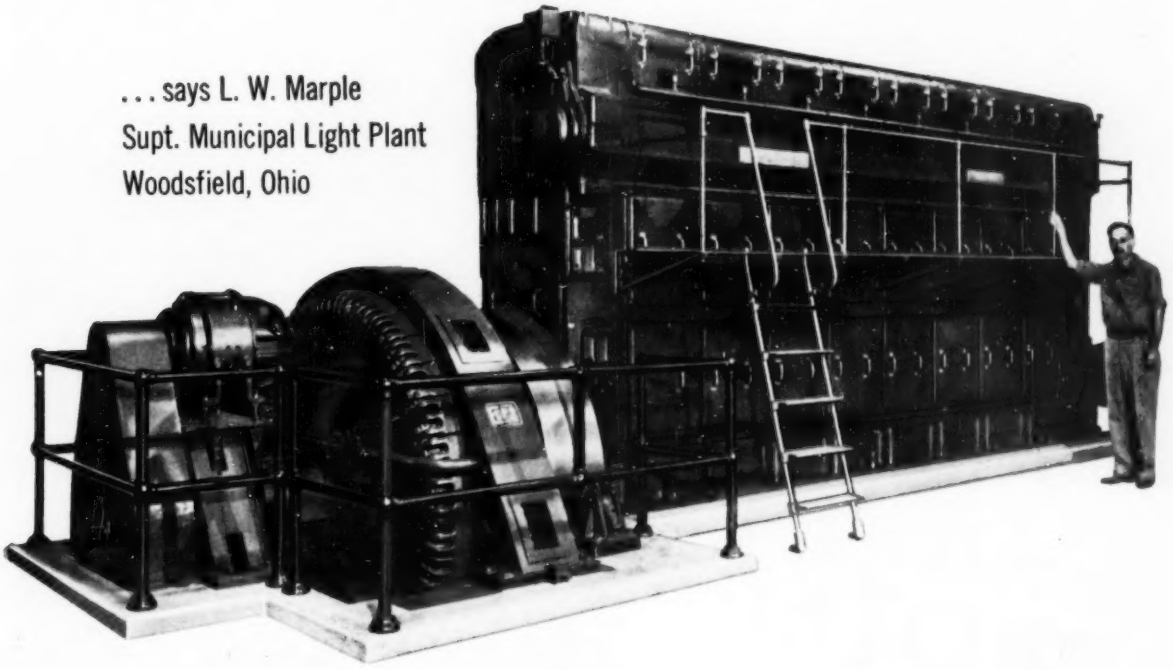
AC GENERATORS
20 kw through 150 kw at 1200 rpm
20 kw through 200 kw at 1800 rpm

DC GENERATORS
20 kw through 90 kw at 1800 rpm
20 kw through 75 kw at 1500 rpm
20 kw through 60 kw at 1200 rpm

SALES OFFICES:
ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DETROIT • HARTFORD • PHILADELPHIA • ST. LOUIS • SAN FRANCISCO

"No More Sticking Rings!"...

. . . says L. W. Marple
Supt. Municipal Light Plant
Woodsfield, Ohio



● "Because of the lubricating oil we were previously using," says Mr. Marple, "sticking rings and carbon build-up were persistent problems on our three Fairbanks-Morse Model 32-E diesels.

"Three years ago, at the recommendation of one of your lubrication engineers, we switched to Sinclair GASCON® Oil D — HD.

"GASCON D — HD has cleared up our troubles . . . no more sticking or broken rings . . . no more carbon build-up, even though our load factor has increased. The result is a considerable savings in maintenance costs.

"We are also getting outstanding results with GASCON in our new 875 H.P. National Superior Dual Fuel Engine."

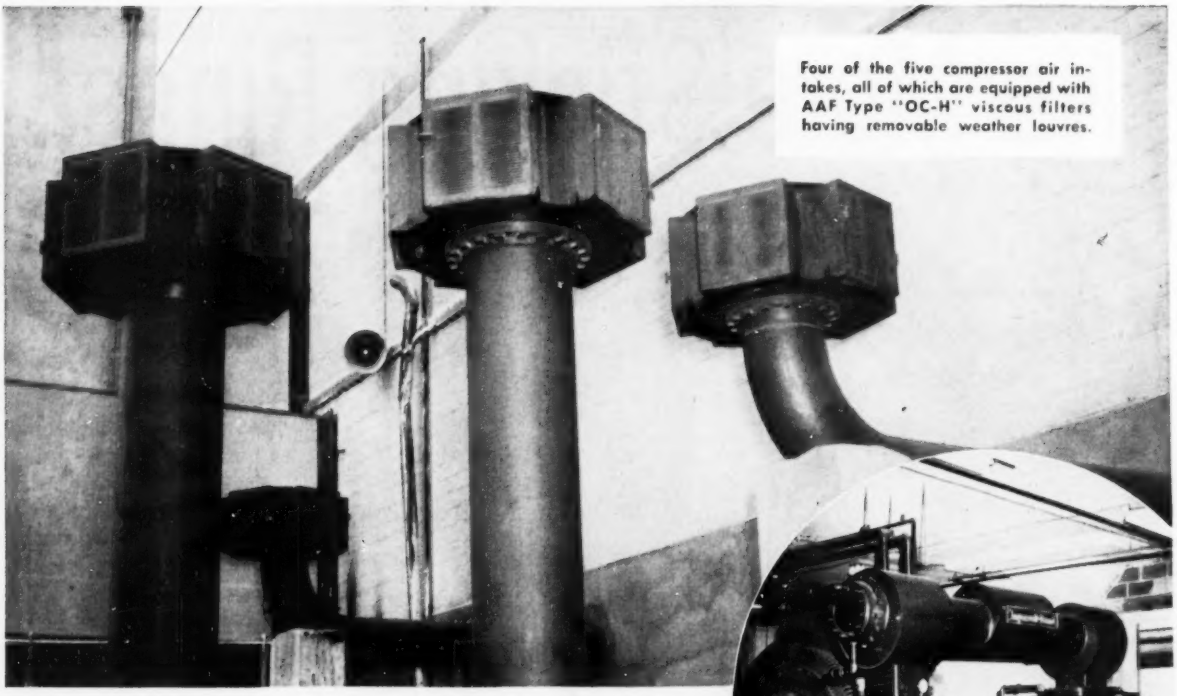
Perhaps a Sinclair Lubrication Engineer can solve *your* lubrication problems. Call your local Sinclair Representative or write to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR

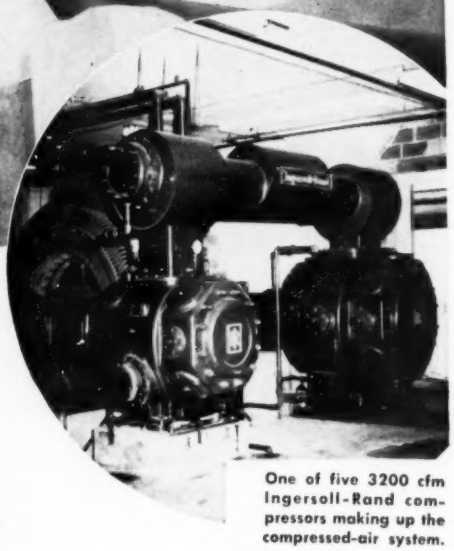
DIESEL

LUBRICANTS

save wear and replacements



Four of the five compressor air intakes, all of which are equipped with AAF Type "OC-H" viscous filters having removable weather louvres.



One of five 3200 cfm Ingersoll-Rand compressors making up the compressed-air system.

FILTERS PROTECT TANK PLANT against air raids from dust

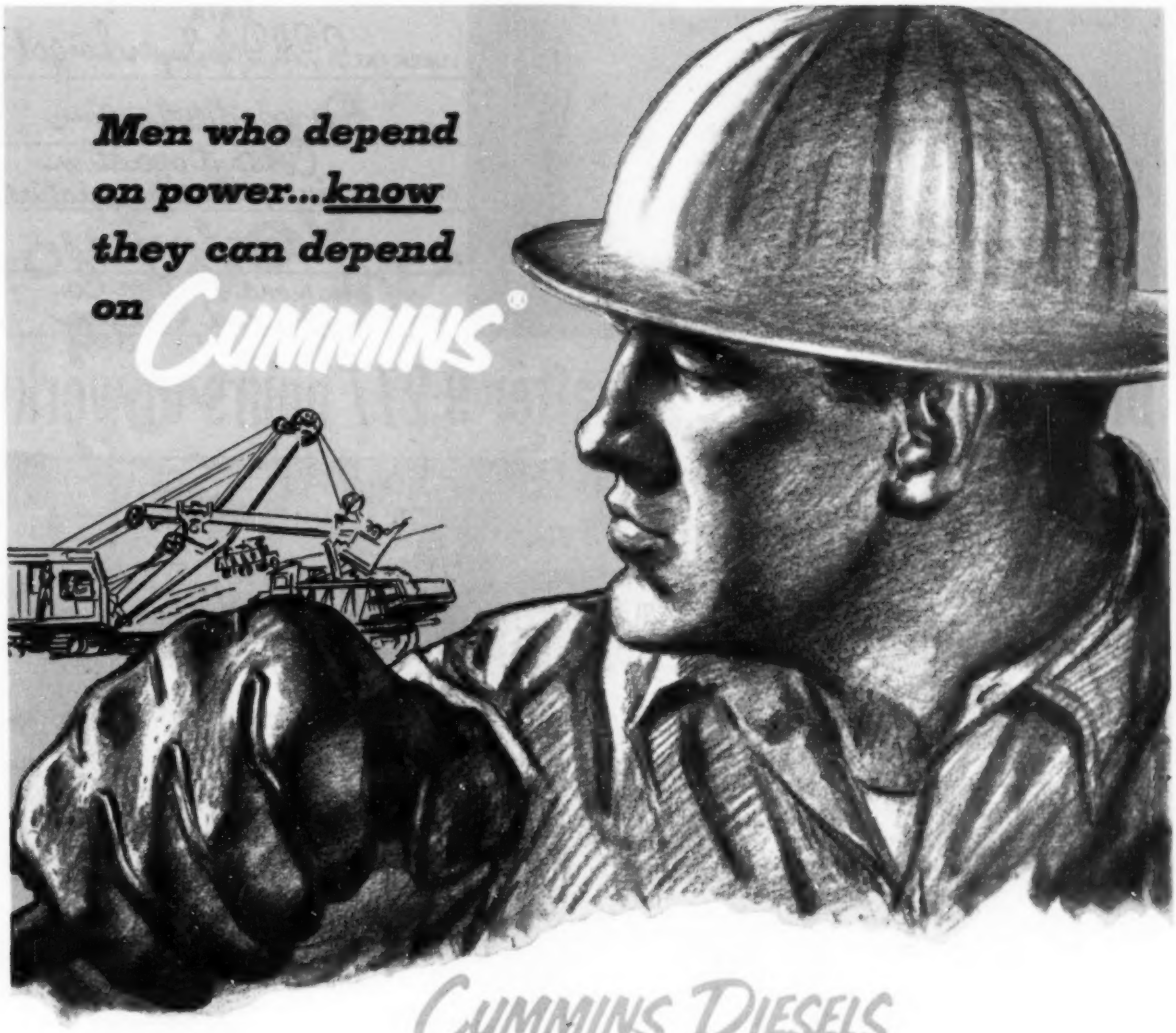
AAF "OC-H" Filters Stand Guard Over Compressed-Air System Serving More Than 2000 Tools

Compressed air is a mighty important commodity at Cadillac's Cleveland Tank Plant. Five 3200 cfm Ingersoll-Rand compressors provide the motive power for over 2000 air-tools and hoists used in producing the famous Walker Bulldog light tanks.

What havoc dust and dirt could play, here, if allowed free access to this vital system! But they're "stopped cold" at the air intake of each compressor by an AAF Type "OC-H" Filter. Selection of this viscous impingement type filter was based on several factors—ease of installation and maintenance, high cleaning efficiency with low resistance to air flow, large dust holding capacity and rugged construction.

Every engine and compressor user should make "clean air" a defense project—and AAF Filters his first line of defense against dust. There's a unit of a type and size designed to deliver clean air to your exact needs and specifications. Write today for complete catalog information.

AAF **American Air Filter**
COMPANY, INC.
445 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.



CUMMINS DIESELS

are engineered to make light work of tough jobs

Leaders in rugged, lightweight high-speed diesel power!

You know it pays to hire the most experienced worker. In the field of rugged, lightweight, high-speed diesels, Cummins has logged more *pioneering* time than any other engine maker.

Yes, Cummins ranks as the leader in boosting diesel power, flexibility and stamina . . . reducing dead weight and bulk. The result: engines that are *tough* yet *mobile!* The story of the modern lightweight, high-speed diesel is the story of Cummins. Today, as in the past, Cummins sets the pace . . . works continuously to produce diesel engines that get more work done at lower cost, that outperform all others on every job.

Find out what a Cummins Diesel (60-600 h.p.) can do in your operations. Your Cummins dealer is ready to give you *all the facts.* Call him today.

CUMMINS

CUMMINS ENGINE COMPANY, INC.
Columbus, Indiana
Export: Cummins Diesel Export Corporation
Columbus, Indiana, U.S.A. Cable: CUMDIEX

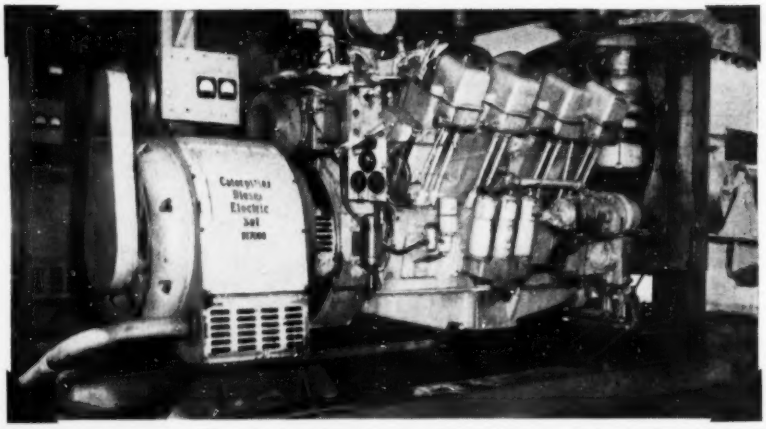
THE ENGINEER'S REPORT

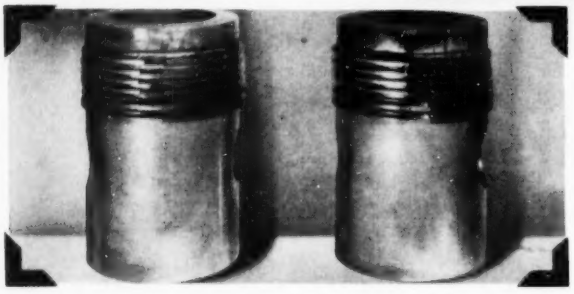
DATA

LUBRICANT	RPM Delo Supercharged-2
UNIT	D17000 diesel engine
OPERATION	Constant operation in extreme temperatures
PERIOD	9277 hours
FIRM	Diamond Lumber Co., Glenwood, Oregon

Diesel engine "spotless" after 9,277 hours of work!

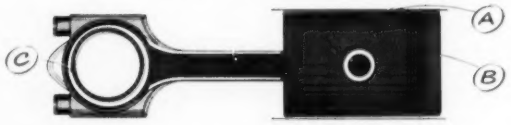
THIS D17000 DIESEL ENGINE worked 17 hours per day in weather that varies from below zero to over 100 degrees. Lubricated with RPM DELO Supercharged-2 Lubricating Oil since installation, it was inspected after 9,277 hours of operation. The engine looked as though it had just been thoroughly cleaned —"spotless" according to the engineer on the job. This is one of six D17000 Cats which was used to supply power for Diamond Lumber Company's mill at Lee's Camp, Oregon. This mill cuts approximately 100,000 board feet of Douglas fir per day.





REPRESENTATIVE PISTONS, exactly as they came from engine after 9,277 hours, show cleanliness of all parts. Wear at top of cylinder liners miked only 0.0015 inch! Con rod and main bearings were all good; valves and valve seats were in excellent condition. The RPM DELO Lubricating Oil in this engine was changed at regular intervals.

How RPM DELO Oils keep engines clean and prevent wear



A. Contain special additives that provide metal-adhesion qualities...keep oil on parts whether they are hot or cold, running or idle.

B. Anti-oxidant resists deterioration of oil and formation of lacquer...prevents ring-sticking. Detergent keeps parts clean, helps prevent scuffing.

C. Special compounds stop corrosion of any bearing metal, and oil foaming in both wet and dry sump engines.

There is an RPM DELO Oil to meet every heavy-duty engine operating condition.

FREE BOOKLET on the RPM DELO Oils gives you complete information. Write or ask for it today.

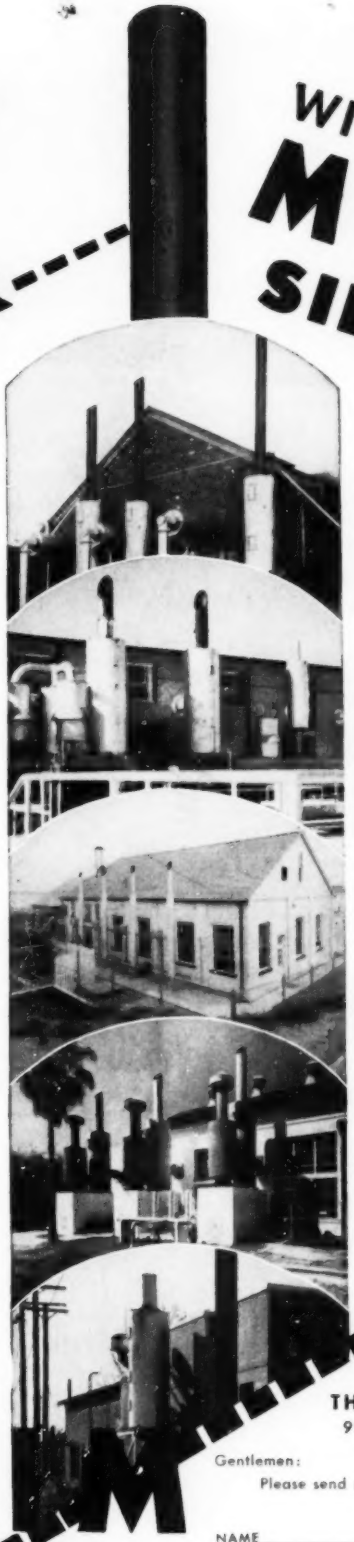
RPM DELO LUBRICATING OILS

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor handling them, write or call any of the companies listed below.

TRADEMARK "RPM DELO" REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA, San Francisco 20 • STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA OIL COMPANY, Barber, New Jersey • THE CALIFORNIA COMPANY, Denver 1, Colorado

YOU'RE ALWAYS A GOOD NEIGHBOR---- WITH MAXIM SILENCERS



When horsepower has to work 24 hours a day in close proximity to residential and business areas, the best exhaust silencing you can get is just downright necessary.

That is one very good reason why public relations-conscious municipal plants from coast to coast choose Maxim Silencers.

Maxim Silencers are backed by longer manufacturing experience, more field use, and the broadest engineering and research background in acoustics available.

Because silencing needs vary so greatly, good engineering advice to start with is almost as important as the product. Maxim engineers know municipal plant problems, and can be of real assistance in planning efficient installations. They are at your service.

Consult **MAXIM**

19MXSIR

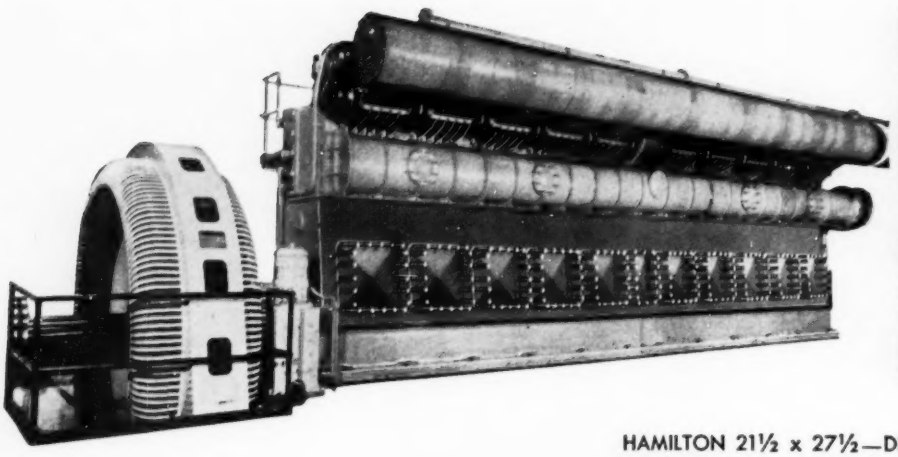
THE MAXIM SILENCER COMPANY
93 Homestead Ave., Hartford 1, Connecticut

Gentlemen:
Please send me your bulletins on Exhaust and Intake Silencers.

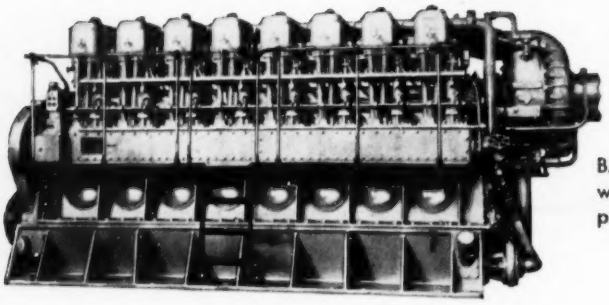
NAME _____

COMPANY _____

ADDRESS _____



HAMILTON 21½ x 27½—Diesel and Dual Fuel Engines available in 5 to 12 cylinders with a net horsepower range from 2250 to 5450.



BALDWIN 600 SERIES—12¾ x 15½ turbocharged Diesels with 6 or 8 cylinders developing 620 to 1750 horsepower at 514 to 625 rpm.

THRIFTIER DIESELS YOU can depend on

For consistent savings in operation and maintenance you can rely on these Baldwin-Lima-Hamilton Diesel Engines. In marine or stationary use you benefit from these inherent characteristics . . . low weight per horsepower . . . rugged construction . . . high efficiency over a wide range of output.

For more facts about these thrifty, dependable B-L-H Diesels, please write us, indicating the speed and load range and the application you are interested in.

Hamilton Works
Hamilton, Ohio

BALDWIN-LIMA-HAMILTON

Editorially Speaking . . . .

Thoughts at an OGP Conference

After a busy week at a technical meeting, it takes a while to get ideas sorted out. Right away we make the first point: *You get ideas.* This particular meeting was the 25th Annual Conference and Exhibit of the Oil and Gas Power Division, American Society of Mechanical Engineers.

It took place the week of May 24th in Milwaukee and was well attended despite formidable competition from another group engaged in following the dynamics of a moving sphere. It seems that there was a ball team in Boston that recently moved to Milwaukee—but we guess that you read about that in the papers.

Getting back to the meeting, one of our first thoughts was, "Boy, what a congregation of diesel and accessory people! There should be a lot of answers here." If we were an actual diesel user instead of a vicarious one (*our secretary says that means that you do the work and we watch you closely*), we are sure that we would welcome such an opportunity to corner some of the best in the business to get some answers, or even to deal out brickbats or bouquets. It was an excellent chance to find out the score—and we don't mean the Braves, although you could have found that out too.

Have you ever seen the inside of a 2-cycle engine cylinder while in operation? Cooper-Bessemer showed such a movie as part of a technical paper. Wonderful job and it gives you a clearer idea of just what happens within the cylinder.

Did you ever sit in on a 3-way discussion on diesel plant design with consulting engineers, engine builders, and top plant superintendents participating? You could have, and have gotten in your licks too. Same thing on ignition in both spark- and dual-fuel engines. Top men from the pipelines, engine builders, and equipment builders kicked this subject around both constructively and entertainingly.

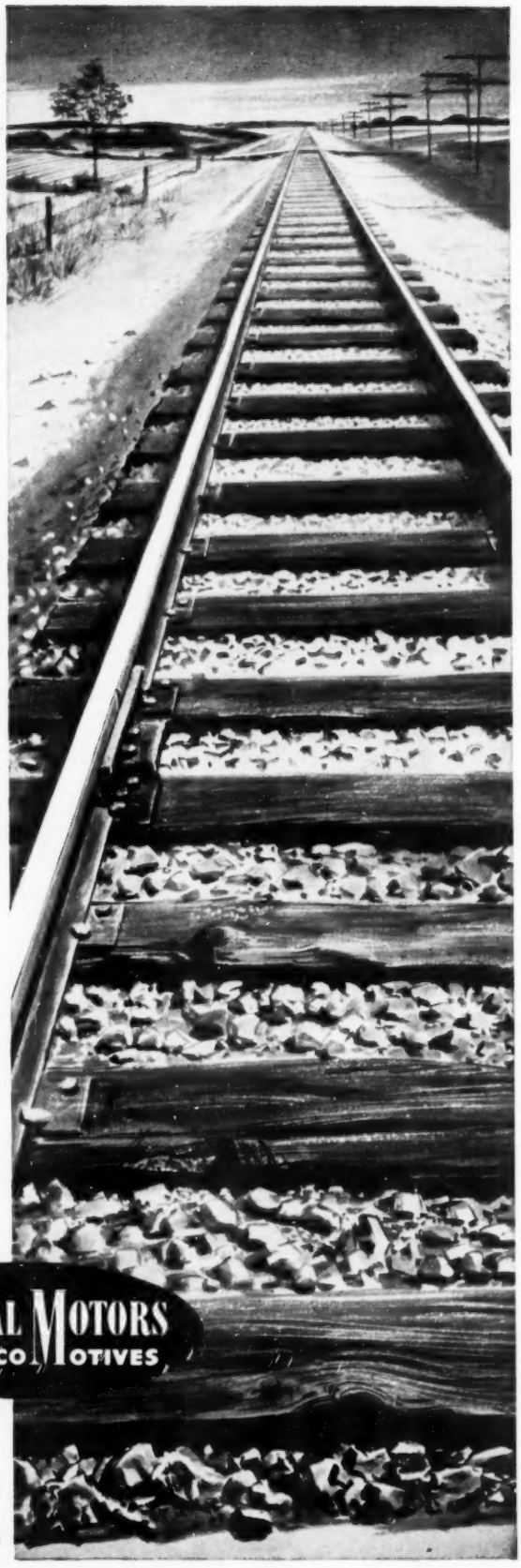
There were a few plant operators and pipeline people present and it is no coincidence that they represented some of the most efficient operations around the country. Why do you suppose that fellows like Everett J. Raushenberger, head of the Internal Combustion Plants Section, Power Division, REA; and G. H. Helmholz from the Operations and Maintenance Unit, attend?

The answer is that there is a lot to be learned—from technical sessions, the exhibits, and the opportunity for personal contact with top men in all phases of the industry. It can be a golden opportunity if you choose to make it so.

If you are holding back because you think these sessions are too technical, it ain't so. Sure, there might be a paper or two that is pretty high level stuff, but that is when you go see the exhibitors or even to the ball game. (*Milwaukee is ahead. Golly, they've got us doing it too.*) By and large, the program is planned to help the user. The General Technical Committee Meeting and Panel Discussions are planned for a maximum audience participation. That's you, bub. Many papers are written to give down-to-earth practical understanding of various engine processes. We learned a lot and you can't say that we are not as dumb as the next guy.

So there it is. We decided that it was a good place to go if you want to learn something. We have sorted out a lot of ideas for future reference, but this is one that we wanted to get across to you now. The next get-together is slated for Kansas City in 1954; it should be a humdinger! Think it over and we'll keep you posted. Oh yes, Milwaukee's Braves are still ahead when last reported.

WE'VE TAKEN A LONG LOOK UP THE TRACK



Even before the Diesel idea began to take hold on the railroads, we realized that the fuel savings and other operating economies of this new motive power were only a small part of what we had to offer.

Years ago we took a long look up the track to see how we could use our skills in building General Motors Diesel locomotives to help railroads achieve lower costs in maintaining this equipment.

We saw that the major components of these hard-working units would need to be rebuilt at infrequent but periodic intervals—that specialized tools, equipment and employes would be needed to do it properly.

So we set up a plan to give our customers immediate delivery of factory-rebuilt assemblies and take worn units in exchange. But we do more than simply rebuild the assemblies. We incorporate the latest improvements in parts and design—in many cases give rebuilt units double the warranty of the originals.

As more and more General Motors locomotives went on the rails, we backed this "Unit Exchange" service with a nationwide network of Factory Branches, equipped with the latest tools and machinery to handle the requirements of the railroads in their territories for rebuilding major components.

This not only saves railroads the burden of making unproductive investments in additional shop facilities, but considerably reduces their parts inventories as well.

Evidence shows that Electro-Motive delivers these fully modernized factory rebuilds at a cost which the railroads are not in a position to attain in shops of their own. In fact, through volume operation and production-line efficiencies, we've been able to make successive cuts in our flat-rate labor charges during a period when other costs of railroad operation were spiraling.

Everyone with a stake in the railroads—investor, executive and employe alike—should know the full story of this unique Electro-Motive service. Write for booklet, "Safeguarding Railroad Earnings." It will give you all the facts.

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

La Grange, Illinois · Home of The Diesel Locomotive

In Canada: GENERAL MOTORS DIESEL, LTD., London, Ontario

+ HIGHLIGHTS +

● Atlantic City, New Jersey will be the location for the summer meeting of the AIEE from June 15 to 19, 1953.

● To bring our nation's 3,300,000-mi highway system up to par, it will take $42-47 billion. Most of the work involved will require diesel-powered equipment.

● Since 1945 more than 9 million motor trucks have been built in the U. S.

● EMD recently shipped parts for the first of four diesel-electric locomotives for the Danish State Railways. It was the first EMD shipment in history to move directly from the port of Chicago to an overseas point.

● A diesel-electric rubber-tired train which needs no tracks has been invented by G. LeTourneau, head of R. G. LeTourneau. Called the Tournatrain, it consists of a locomotive and four cars.

● According to the Erie Railroad, one railroad recently solved a water shortage problem in a community when it gave the town its wells after it had converted almost completely to diesel power.

● SAE's National Tractor Meeting and Production Forum will be held at the Schroeder Hotel in Milwaukee, Wisconsin from September 14 to 17, 1953.

● For the first time, Westinghouse will exhibit a cutaway model of the gas turbine and generators for a 3000-hp gas turbine-electric freight locomotive unit at the AAR convention in Atlantic City, N. J. The date—June 22 to 27, 1953.

● Funny scenes and comic mice, or serious thoughts and sound advice —you can have your choice from the National Safety Council's new 1953 directory of Occupational Safety Posters. Copies are available from the Council at 425 North Michigan Ave., Chicago 11, Ill.

● "Operation Scrounge"—According to Steelways, half of the tanks, artillery and infantry weapons, and two-thirds of the wheeled vehicles used by the United Nations' forces in Korea have been salvaged from scrap piles and reconditioned.

● As of May 1, 1953, Class I railroads had 832 new diesel locomotive units on order.

● The American Road Builders Association has moved its headquarters to 918 16th Street, N. W., Washington, D. C.

● Mobile hangars are a recent development. Their primary use is to house jet interceptor aircraft. Powered by diesel, the hangars are self-propelled. Look for detailed article on these in a coming issue.

● The Georgia Hotel in Vancouver, B.C., Canada, will be the scene of the SAE International West Coast Meeting from August 17 to 19 inclusive.

● The American Association of Railroads will hold its convention in Atlantic City, New Jersey from June 22 to 27, 1953.

● GM Diesel of Canada has recently expanded its plant in order to provide increased rebuilding and repair services.

● Yale and Towne lays claim to the world's largest diesel-electric lift trucks. The giant units were developed primarily for use in the Steel industry to boost production of "mile-a-minute" rolling mills.

● Highlight of the Cooper-Bessemer Corporation's exhibit at the Tulsa Oil Show was an ultra high-speed motion picture of actual fuel combustion inside an internal combustion engine cylinder. Part of C-B's research program, the film was taken at 20,000 frames per sec to reveal hitherto unknown burning characteristics of different fuels.

● EMD's factory branch at Robertson, Mo., recently turned out its 3000th traction motor.

● Europe's trade fairs are the subject of an illustrated booklet currently being offered by the European Travel Commission, 295 Madison Ave., New York City.

● ASTM will hold its 56th annual meeting from June 28 to July 3, 1953 in Atlantic City, New Jersey.

● The "Killer" type submarine whose function it is to seek out and destroy enemy undersea craft before our coast or shipping can be attacked, is powered with engines built by GM's Cleveland Diesel Engine Division.

● During 1952 the Pennsy road placed 333 new diesel-electric units in service. This added over 500,000 hp to the road's diesel fleet.

● B&O scientists are currently studying the use of radio-isotopes in railroading as a possible maintenance tool.

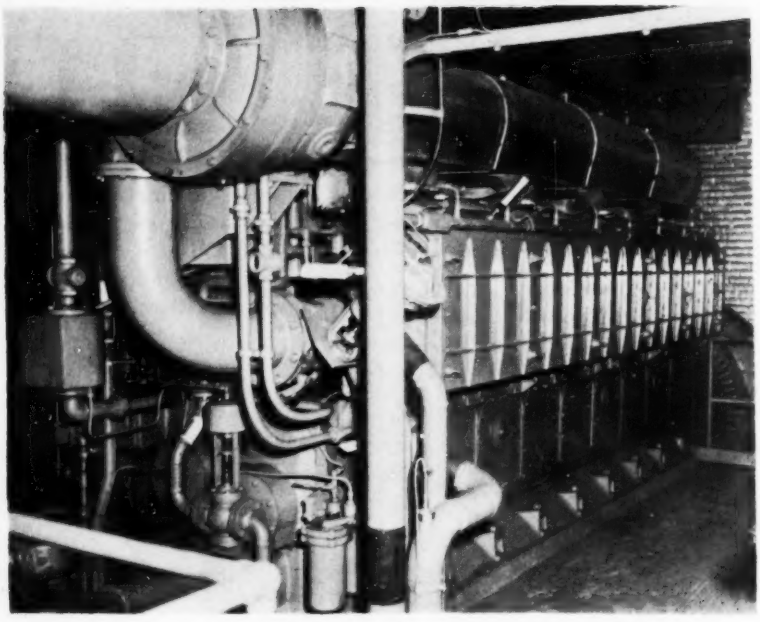
● In 1929 the average daily mileage per serviceable freight locomotive was 91.2 miles. Today the figure has increased by more than 39 per cent.

● Production of crude oil in the United States set a new record in 1952. An increase of 44 million bbl over the 1951 figure brought the total up to an estimated 2,291,997,000 bbl in 1952.

● From the AAR we hear that since the end of World War II, railroads have purchased nearly 18,000 new diesel-electric locomotive units.

● Single-unit diesel-electric rail buses are being tried out in New England on branches where passenger service had virtually disappeared and where regular railroad service had been abandoned. These units cost considerably less to operate, not to mention a much smaller capital investment.

First commercial installation of Nordberg's Supairthermal engine as a dual-fuel unit is in municipal power generation service at Lindsey, Oklahoma. Substantial fuel cost savings were immediately realized.



The new Nordberg Supairthermal dual-fuel engine at Lindsay, Oklahoma—looking from the turbo-charger end.

First Supairthermal Duafuel Installation

By C. H. Guernsey Jr., C. H. Guernsey and Co., Consulting Engineers

LINDSAY, Oklahoma, has already realized benefits from its new engine. It is a Nordberg 4-cycle Supairthermal unit arranged to operate on the dual-fuel principle, the first to enter commerical service. Designated Model FSG-138-HSC, the 8-cyl unit has a rating of 1425 hp at 450 rpm. Cylinder bore is 13 in and the stroke, 16½ in. It went on the line August 8, 1952, and since then has been operating 98 per cent of the time.

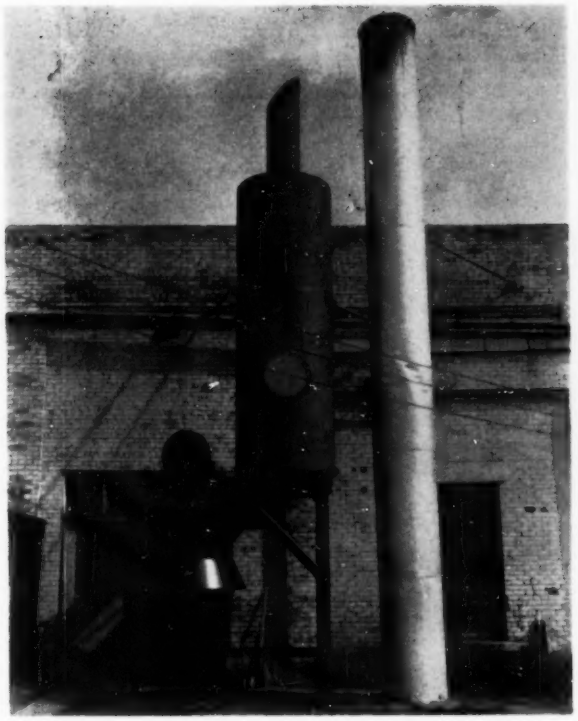
This has resulted in a savings in fuel cost of over $1200 per month under the cost of operating the remainder of the plant's straight oil engines. The savings alone will pay for the unit in less than 10 years time. This is, of course, somewhat typical of the combination gas and oil operation of practically all makes of dual-fuel engines when compared with straight oil operation. It is due primarily to the basic difference in the cost of fuels. In this southwestern area where natural gas and oil are both plentiful, the cost of one million Btu HHV (high heat value) in gas and oil is approximately $.16 and $.60, respectively.

From the very beginning, the Nordberg engine has operated satisfactorily on dual fuel. As of March 13, 1953, the engine operated a total of 4670 hours generating approximately 1,700,000 kwh. Average fuel consumption over a 7-mo period was 11 cu ft per kwh with approximately 10 per cent pilot oil at partial load. Monthly load factors ranged from 54 to 63 per cent during this period. The cost of high quality natural gas (1048 Btu per cu ft LHV) is relatively cheap (18 cents per mcf for first 1750 mcf and 12½ cents per mcf thereafter). Pilot fuel oil of 19,000 Btu per lb (HHV) is available for 8 cents per gal. This results in an overall average unit fuel cost of 2.5 mills per kwh compared with approximately 7.4 mills per kwh fuel cost of operating 10- to 15-year-old straight oil engines.

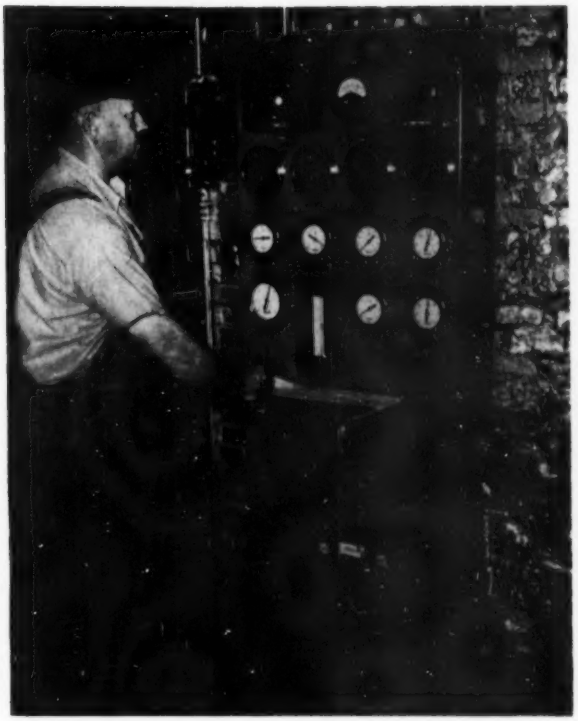
Although the manufacturer's guarantee on lube oil consumption was the usual 5000 hp hr per gal, this engine has maintained a lube oil economy of approximately 18,000 hp hr per gal based on rated horsepower or 7000 hp hr per gal based on developed horsepower.

Until about eight years ago, Lindsay was a small agricultural community in central southern Oklahoma advertised as the "Broom Corn Capital of the World". Then the oil boom came, with Lindsay in the very center of the "Golden Trend" Oil Field development and the logical location for branch offices of oilfield equipment and service companies and families of workers. The power load demand increased during these years on an average of 96 kw per year, which in this town amounts to an annual increase of 15 per cent. Adding the increased load due to the oil boom to the normal increase in unit power consumption per consumer, due to new and better electrical appliances, spelled additional generating capacity if the local municipal government was to stay in the power business.

Although power is available from the Southwestern Power Administration, a short distance from town at



Intake air is filtered by means of a combination oil-bath type cleaner and silencer of the Cycoil design, supported on the same framework as the exhaust silencer.



Chief Operating Engineer Rome Johnston is responsible for the proper operation and maintenance of Lindsay's municipal power plant.

attractive wholesale power rates, the City of Lindsay through a bond issue in 1951 decided to continue municipal generation since it is the main source of revenue for operation of other municipal activities. Also, the economical operation of modern dual-fuel engines makes the unit cost of municipal generation approach the low wholesale electric rates obtainable from hydro-steam public power agencies.

The Nordberg unit, although the second from low bid on a unit cost basis, was selected from a group of 14 engine-generator proposals representing five different engine manufacturers. The engine, generator, and all auxiliary equipment, including a radiator, were installed for a contract price of $131.83 per kw of capacity. This price did not include the engine foundation ($6.80 per kw) or the power wiring and modification of switchboard power panel ($4.80 per kw).

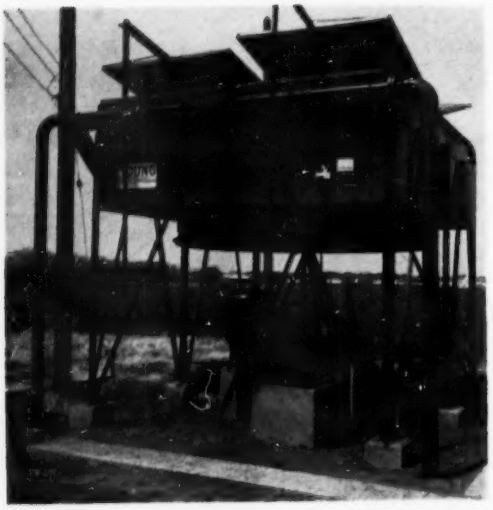
Installation space was a problem since all available generating unit locations were used. It was decided to remove one of two obsolete semi-diesels and utilize the space for location of the new unit. However, this space was limited to approximately 26 ft. The Nordberg unit with an overall length of 25 ft, 4 in, fit very nicely into the limited space and eliminated the necessity for costly building expansion. The engine-generator foundation required only 66 cu yd of reinforced concrete, which is a relatively small foundation considering the power output of the unit.

The much publicized Supairthermal engine utilizes an Elliott turbocharger which compresses the intake air to approximately 15 psi, consequently raising 90°F. ambient air to about 240°F. The exhaust manifold is insulated with mineral insulation rather than water-jacketed. This is neccessary since the high pressure turbocharger requires all available energy from exhaust gases to compress the intake air.

In order to remove the disadvantageous effect of high air temperature on power output, intake air must be cooled to approximately 100°F. This is accomplished by a simple shell and tube-type intercooler. An adequate supply of water with a maximum temperature of 80°F is obtainable from a storage reservoir of the municipal waterworks system. Since the water is normally pumped from the reservoir into one main leading to town, it was decided to add one pump exclusively for the intercooler but with provisions to bypass.

This pump takes suction in the reservoir and discharges through the shell and tube intercooler to the water main against a pressure of approximately 65 psi. Although the Oklahoma State Health Department allowed the use of domestic water for cooling the intake air, since it is a closed system with no chance for contamination, they did limit the allowable temperature to a 6°F maximum to reduce the possibility of algae growth in the summertime. With this small allowable temperature use, the water pumping rate is increased to about 270 gpm under full load operation. None of this water is wasted as the intercooler water pump functions as a transfer pump in the waterworks system.

A radiator was selected as being the most satisfactory



Engine jacket water passes through this dry air cooler and then through a shell and tube-type heat exchanger for lube oil cooling

Principal Equipment

Engine	Nordberg Mfg. Co.
Generator	General Electric Co.
Exciter	General Electric Co.
Drive	Link-Belt Co.
Cooling System	
Jacket Water Cooler	Young Radiator Co.
Intercooler	Young Radiator Co.
Lube Oil Cooler	Young Radiator Co.
Water Treatment	Sola Catalytic Co.
Automatic Control Valves	Fulton-Sylphon Co.
Cleaners	
Intake Air	American Air Filter Co., Inc.
Lube Oil Purifier	The Hilliard Co.
Gas Scrubber	Black, Sivalls & Bryson
Exhaust Muffler	Maxim Silencer Co.
Pumps	
Water	Allis-Chalmers Mfg. Co.
Auxiliary Lube Oil	George Roper Co.
Instrumentation	
Alarm Panel	Viking Instruments, Inc.
Gauge Board	Nordberg Mfg. Co.
Pyrometer	Alnor, Illinois Testing Labs.
Thermometers, Dial-Type	Weksler Co.
Pressure Gauges	Lonergan Co.
Pressure Switches	Roy Co.

cooling method for the engine jacket water, which in turn cools the lubricating oil through a shell and tube-type heat exchanger. Local water is rather hard, having a total hardness rating as calcium carbonate of 510 ppm or approximately 30 gr.

To prevent scale deposits and inhibit corrosion with the jacket water temperature maintained at approximately 150°F to 160°F, a Sola catalytic cell was installed in the original installation and as of this date is doing an excellent job keeping engine jackets, pipes, and radiator tubes free from scale and corrosion.

It has been known since the development of the dual-fuel diesel engine that throttling of intake air at low loads favored dual-fuel operating economy. However, the control of this throttling by means of a butterfly valve in the intake air line has not always been satisfactory although several different methods have been used to vary the air throttling with changing load, such as manual control, direct linkage with governor, indirect hydraulic control by governor, and exhaust temperature sensitive control through pneumatic motor and linkage. The last has proven to be the most sensitive and positive control and a Bristol control is included in the Lindsay installation.

Lube oil is cleaned by passing through a continuously operating bypass-type purifier using cellulose-type filters. The auxiliary lube oil pump, which will deliver approximately half of the engine-driven pump capacity, is used for before and after service. Once manually started, it is automatically controlled by lube oil pressure, shutting down when the engine-driven pump takes over upon engine start-up and coming into service again as the engine is shut down.

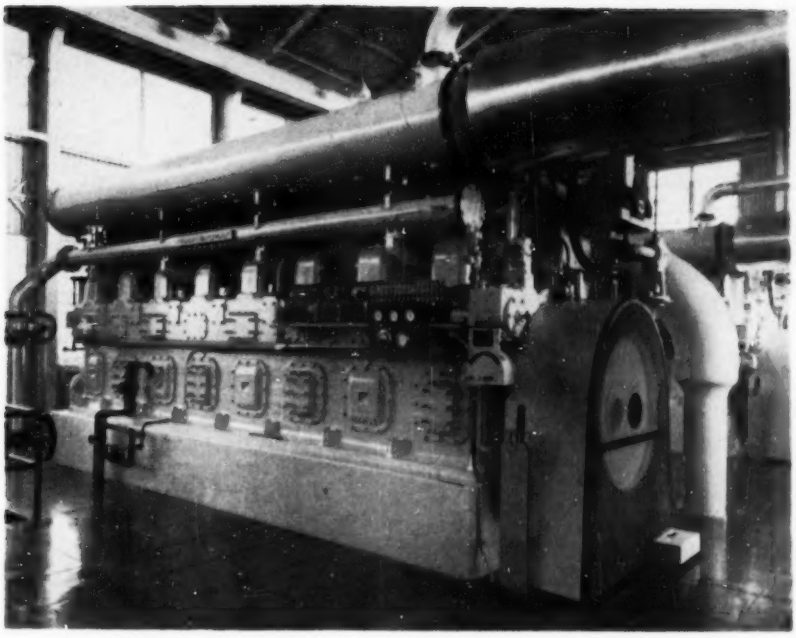
A central control and instrument panel was specified to be furnished which included flush-mounted pressure gauges with snubbers, dial-type thermometers, exhaust pyrometer, crankcase manometer, alarm panel, remote control push button stations with pilot lights for controlling operation of jacket water pump, intercooler water pump, lube oil purifier pump, lube oil "before and after" pump, and a 2-speed radiator fan.

Fortunately, the generator panel used by the removed semi-diesel could be modified and adapted for use with the new generating unit. This helped to keep the total installation cost to a minimum.

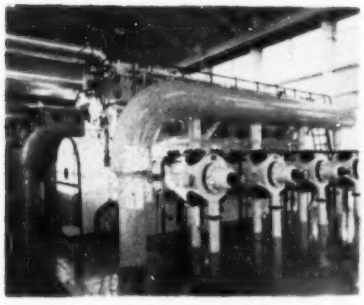
Because of the savings now being realized in efficient generating plant operation, Lindsay has reduced the rate charged for electric energy approximately 15 per cent. Although revenue is lowered somewhat from the former level, there is still enough net profit realized to operate the fire department, street department, police department, park department, water department, cemetery, and take care of all other municipal expenses; and in addition to make improvements such as the current modification and modernizing of the electrical distribution and whiteway street lighting systems.

Last year the city paid all expenses, set back $28,000 for a sinking fund and still had over $24,000 surplus in the bank. There are no taxes with the exception of a 6.5 mill ad valorem tax to retire bonds voted to purchase the new generating unit.

Credit for the realization of economical generating plant operation through the installation of one of the most modern of engines and the first commercial installation of its size and type should go to the governing body of the City of Lindsay, composed of Mayor Dee J. Riley; Councilmen Floyd Garrett, Frank Miller, John Cates, Jess Brown, Skeet Ferguson, Councilwoman Mrs. Waldron; and City Manager A. C. High. Responsible for operation and maintenance of the municipal power plant is Chief Operating Engineer Rome Johnston.



The five 1600-hp Worthington engine-compressors installed at McComb, are designed to handle 475 million cu ft of gas daily.



New Compressor Stations Boost Pipeline Capacity

Erect eight compressor stations and string 1735 miles of pipeline. This was the goal of United Gas' three-year expansion program. Now, lets take a look at the first compressor station—McComb, Mississippi.

FIRST of the new compressor stations to go into service in United Gas's three-year $250 million expansion program was the McComb, Mississippi, plant. Here, five 1600-hp Worthington spark ignition gas-engine-compressors are in operation handling 390 million cu ft of gas per day.

The total program, scheduled for completion in 1953, includes eight compressor stations and 1735 miles of new pipe line. End results will be to make the system capable of delivering more than four billion cu ft of gas per day, improved flexibility of operation, and development of new natural gas reserves.

System Arrangement

The McComb station is one of the key installations on a new 30-in line that carries gas from Louisiana fields and from underwater wells out in the Gulf of Mexico, north to Jackson and Kosciusko, Mississippi. McComb also is the terminus of a 24-in line from the Baxterville field 41 miles to the southeast, and can either take gas from this field for delivery northward or can reverse the flow and pump gas through the Baxterville line to towns in Mississippi or Mobile, Alabama and Pensacola, Florida.

Three new stations of which McComb was the first move gas into or along the 30-in line. At Lafayette, Louisiana, four 1100-hp Clark engine-compressors push gas from the Iowa-Franklin line eastward to Bayou Sale Junction where it joins gas from offshore fields and other south Louisiana wells. About 84 miles north, on the 30-in line, is the Montpelier station with major equipment much the same as that at McComb.

The Montpelier station with five 1600-hp Worthington natural gas engine-compressors is designed to take a total of 475 million cu ft of gas daily at 720 psi and discharge it at 874 psi toward McComb, approximately 54 miles to the north.

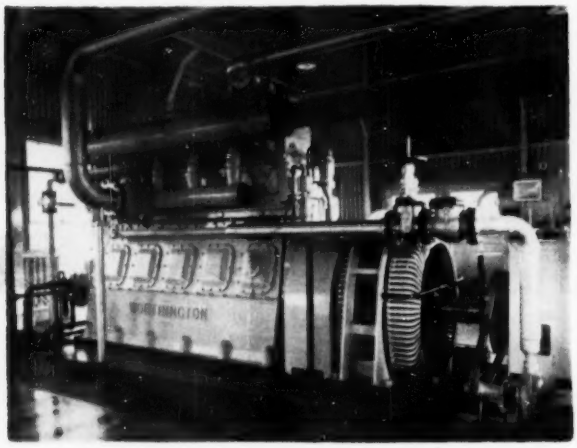
The 30-in line delivers gas to McComb at 727 psi and the compressors discharge it at 902 psi toward Jackson,

68 miles north, and then on for another 58 miles to Kosciusko. Gas in the 24-in line comes from Baxterville under natural well pressure which varies somewhat but averages 727 psi at the McComb inlet.

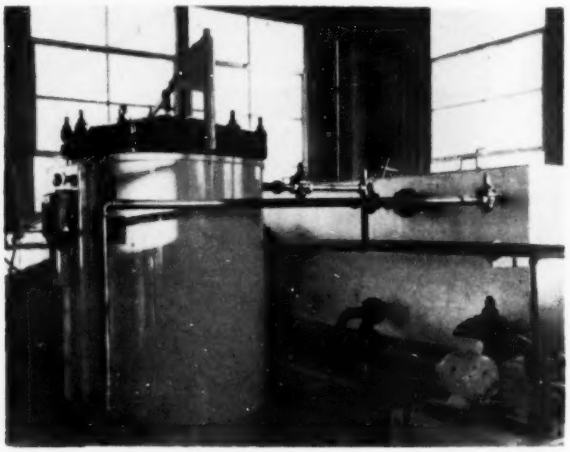
Compressor stations were designed by United Gas engineers to meet three basic requisites; efficiency, reliability, and safety. This has been achieved through use of heavy-duty prime movers, ample protective accessory equipment, and elaborate fully automatic safety devices.

Gas reaches the McComb station in parallel 30- and 24-in lines and is measured with orifice meters. The meter house contains a dual system for the Baxterville line so that flow can be measured in either direction. Next comes a scrubber installation with four units arranged in parallel. The big gas lines are arranged so that all five compressor units can take gas fom the 30-in suction line and discharge to the 30-in line going north. Compressor units No. 1, 3, and 5 are also equipped for sending gas in either direction on the 24-in Baxterville line.

Fuel for the engine-compressors is bled from either the 30- or the 24-in suction lines. Fuel lines of 3-in diam pass gas through regulators which reduce the pressure to 200 psi, then through meters and another set of regulators which cut the pressure down to 30 psi at which fuel gas is fed to the engines.



The station's electrical requirements can be met by this 445-hp auxiliary engine should commercial power fail.



When necessary, engine lubricating oil is transferred to this tank in the auxiliary building and put through a Hilco Hyflo filter.

Engine and Accessories

The five engine-compressors are Model UTC-168 Worthingtons, each rated 1600 hp at 320 rpm. Each of these 2-cycle natural gas engines has eight vertical power cylinders of 16-in bore and 16-in stroke. Fuel gas in the eight power cylinders is ignited by four magnetos. Each magneto serves four cylinders thus providing double ignition for each cylinder.

Equipment and attention devoted to lubricating oil purification exemplifies the care in plant design and operation to insure that the engines perform with a minimum of downtime for maintenance. A good quality oil is purchased in transport truck lots of 3500 gal and stored in a 12,000-gal tank. As makeup is required, a motor-driven pump transfers lube oil from storage to the engine crankcases or to the cylinder lubricators as selected. A meter at each engine measures the oil added to either system.

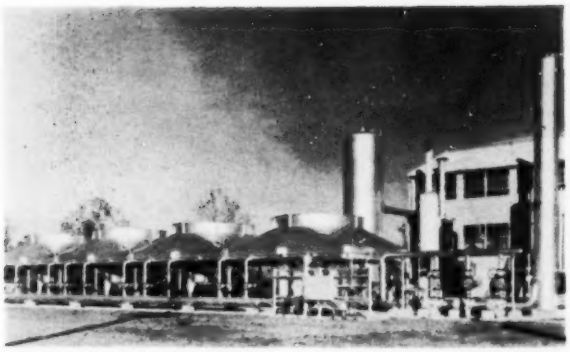
The pressure lube circuit of each engine includes a full-flow mechanical filter, a full-flow 18-cell cartridge-type filter, and an 8-cell partial-flow cartridge-type fullers earth filter. In addition, lube oil can be drained from an engine crankcase or blown by compressed air from the filters to a dirty-oil tank in the adjoining auxiliary building. Settling removes some of the impurities in the dirty lube oil. It is then passed through fullers earth type filters after which it can be reused. Company engineers plan to raise operating temperature of the jacket water from 160°F to 180°F, thus raising the temperature of the lube oil and, hence, the crankcase in order to improve efficiency by reducing condensation in the crankcase of the engine.

Jacket water for the engines and cooling water for the engine oil is cooled in four dry air-coolers outside the compressor building. Three motor-driven centrifugal pumps circulate the cooling water to cool the engine oil. A belt-driven centrifugal pump on each engine, connected to the engine shaft, circulates the cooling water through the engine jackets and the dry air-coolers. Each dry air-cooler has a separate section for the lube oil cooling water and the engine jacket water. Water temperature in the engine jackets is maintained by automatic thermostatic controls which bypass water around the coolers and control the radiator fans.

Scavenging air for the engines is drawn through automatic self-cleaning filters and supplied to the cylinders by a pair of scavenging air pumps driven off each crankshaft. On each engine is a panel with pressure gauges for water, lube oil and fuel gas, a tachometer, and a multipoint exhaust pyrometer.

Safety a Factor

In any gas compressor station the safety of personnel and equipment rates careful consideration and at McComb



Cooling water for the five engines is circulated through four dry air coolers by centrifugal engine-driven pumps.

(as in other stations) elaborate precautions have been taken. Engines are shut down automatically if lube or fuel gas pressure fails or if water temperature rises above prescribed limits. When necessary it is possible to bypass gas around the station. Large hydraulically motor-operated valves on the suction, discharge, and bypass lines can be set to bypass the station simply by electric pushbutton control. At the same time controls would ground the magnetos, shutting down the engines.

This is by no means the full extent of the safety precautions. The station is equipped with automatic control devices actuated by pressure differential in the gas lines. If there is a sudden increase in pressure differential such as would be occasioned by a break in a gas line, the safety control automatically actuates a mercury switch which causes the suction and discharge valves to close and shuts down the engines by grounding the magnetos. Thus, in the event of a line rupture, operators need only think of their own safety, knowing that the station will be shut down and isolated automatically.

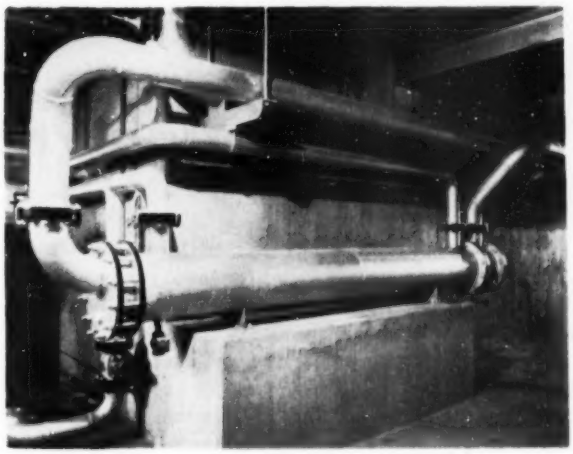
Operation of central solenoids is dependent, of course, on availability of electricity. Normally, the station is supplied with purchased power from a utility company line, but in the auxiliary building is a Model CCG-5 Worthington natural gas engine rated 445 hp at 514 rpm direct-connected to a 300-kw Electric Machinery synchronous generator. This unit makes the station self-sufficient, supplying the safety system solenoids and other emergency requirements if the station power supply fails.

Summary

The McComb station started regular service on April 3, 1952 and has been in continuous operation since May. The other two stations in this section of the system followed into service last summer, the Lafayette station on July 22 and the Montpelier station on August 1.

To handle about 390 million cu ft a day, McComb has averaged about 2250 engine hours a month, which means three engines at full load 24 hours a day. In practice, of course, this means occasional operation of four engines. Operators rotate units so that each engine gets an equal share of the work. It is anticipated that the station load will be increased about 25 per cent this spring with delivery of an additional 95 million cu ft per day. This will bring all five engine-compressors into full service.

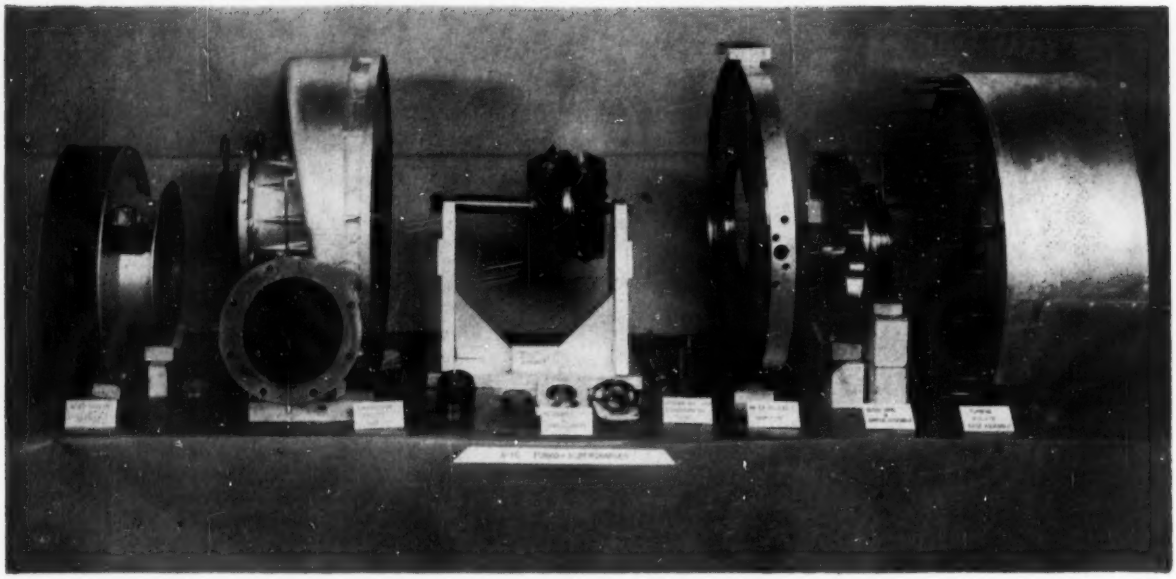
Engine lube oil is cleaned continuously by a full-flow filter of the cellulose-cartridge type and a fullers earth-type by-pass filter. Lube oil for each engine is cooled in a shell and tube-type heat exchanger (below).



Sound design and operation are paying off. The new station has been remarkably free of "bugs" and there has not been a single enforced shutdown because of engine failure.

Principal Equipment

Engine-Compressors	The Worthington Corp.
Magnetos	American Bosch Corp.
Regulators	Fisher Governor Co.
Orifice Meter	Commercial Iron Works
Valves	Walworth and Nordstrom
Automatic Controls on valves	EIM Co.
Scrubbers	King
Lube Oil	Shell Oil Co., Inc.
Lube Filters	The Hilliard Corp.
Exhaust Silencers	Maxim Silencer Co.
Air Compressors	Ingersoll-Rand Co.
Auxiliary Engine	The Worthington Corp.
Generator	Electric Machinery Mfg. Co.
Gauges	Jas. P. Marsh Corp.
Pyrometers	Illinois Testing Labs. Inc.
Switchgear	Nelson Electric Mfg. Co.
Instruments	Westinghouse Electric & Mfg. Co.
Tachometers	Reliance
Lube Filter	Cuno Engineering Co.
Lubricators	McCord Corp.
Meters on lube	Pittsburgh Meter Div. of Rockwell Mfg. Co.
Oil coolers	Sims Co., Inc.



DeLaval's High-Pressure Turbocharger

EVERY day, turbocharging is establishing new benchmarks from which diesel performance may be judged. Higher specific outputs and lower specific fuel consumption are two of the major advantages.

At the time that turbocharging was introduced, normally-aspirated engines were operating with continuous ratings in the order of 80 bmep. With the introduction of the first system of turbocharging, specific outputs were increased to 120 bmep. This was accomplished by the relatively low precompression of the scavenging air to about 1.4 atmospheres. This 50 per cent increase in specific power, plus improved fuel consumption or improved thermal efficiency, rendered turbocharging practically an economic necessity for medium and large size diesel engines.

Higher inlet manifold pressures promised still greater advances and so tremendous amounts of research have been applied to the search for turbochargers capable of producing higher pressures. In the present state of development of high-pressure turbochargers, there has been considerable improvement in specific fuel consumption and full-load engine ratings of 180 psi bmep are being achieved. The full possibilities of high-pressure turbocharging have not been reached.

The Problem ● To understand the problems involved in attaining higher turbocharging pressures, it is necessary to know some of the background. The original low-pressure system was of the "blow-down" type that utilized the pulsating energy of the exhaust gases to drive the turbine wheel which, in turn, drove the centrifugal air compressor.

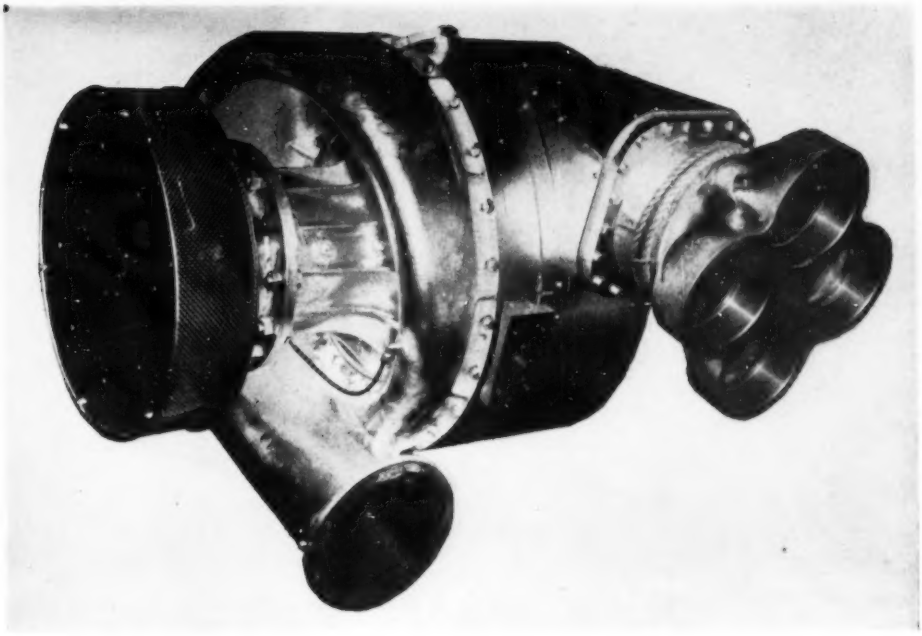
With the low intake manifold pressure, high exhaust manifold pressures would interfere with scavenging, particularly during the blow-through period. For this reason, cylinders apart in the firing order are connected to separate exhaust manifold branches. Thus, the blow-down from one cylinder does not interfere with the scavenging of another. In fact, the timing of events is such that blow-through occurs during minimum exhaust manifold pressure.

Energy of the exhaust pulsations is not sufficient for driving the turbine for high-pressure turbocharging. Additional exhaust energy must be made available and utilized more efficiently. For more energy, it is necessary to increase the pressure in the engine exhaust manifold from which the turbine is supplied.

This means that the engine must operate against appreciable back-pressure. If engine operation is to be efficient, the inlet manifold pressure must be substantially higher than the back-pressure.

The turbocharger may be considered as a low-pressure gas turbine. The input is the heat and pressure energy in the exhaust gases; the net output is represented by the difference between intake and exhaust manifold pressures. The gas turbine's net output is very sensitive to the efficiencies of the turbine and compressor.

High efficiency of the component parts—turbine and compressor—is therefore necessary since the result of a low differential between the intake and exhaust manifold pressures will be noticed in engine operation. Fuel con-



From left to right are: inlet screen and sliencer; compressor volute case; complete rotor assembly; water cooled partition; guide vane and shroud assembly; and turbine volute case assembly. The assembled unit is shown above.

sumption rates will suffer and thermal loading will increase. Conversely, a high differential pressure will produce the following effects:

1. During the scavenging period (valve overlap), a large volume of air flows through the cylinders. This has a marked cooling effect on the parts.
2. Residual exhaust gases will be completely purged from the cylinders. This prevents dilution of the air charge and also keeps its temperature at a minimum. The effect is beneficial on the mean cycle temperature and on thermal efficiency.
3. Engine indicator diagrams show a positive area during the exhaust and suction strokes. Thus, the waste energy in the exhaust gases are converted into net power output in the turbocharger that is transmitted pneumatically to the engine crankshaft.

While this is true to some extent of all turbocharging systems, the effects are accentuated as the supercharging pressures increase. Obviously, higher turbocharging pressures are desirable.

DeLaval's Answer ● DeLaval has designed and developed a turbocharger expressly for high-pressure turbocharging. The Series A model is being built in two sizes—the A-10 and the A-14—and was designed for a pressure ratio of 2:1 under full-load engine operating conditions. The ratio is slightly higher under overload ratings. Later models are being planned to produce 3:1 ratios under full-load conditions.

Bearing in mind the importance of component efficiency, many years of painstaking research and experimentation were devoted to obtaining the highest possible efficiency of both turbine and compressor. A departure from conventional practice, both the compressor and turbine are of the "mixed-flow" type wherein the flow of gases is partly axial and partly radial.

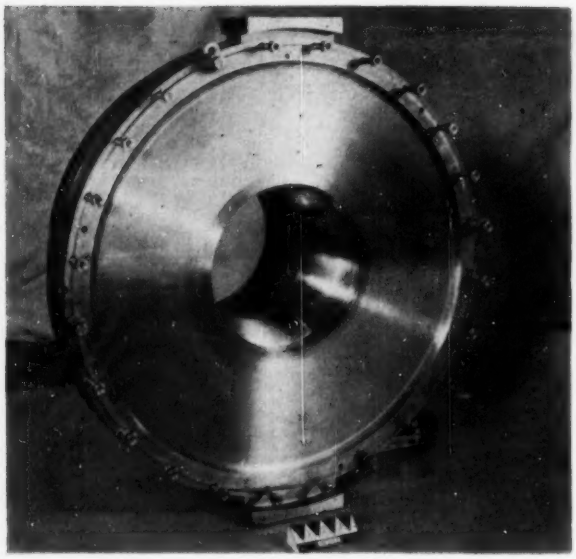
DeLaval originated this type of compressor over 25 years ago. The design has been refined aerodynamically and structurally to fit this service. The efficiencies and performance characteristics obtained are considerably better than can be obtained with either the conventional axial- or radial-flow type units.

Similarly, the design of the turbine is based on the mixed-flow centripetal turbine—a DeLaval "first" that dates back to 1928. The desired turbine characteristics and high efficiency could not be obtained with the conventional axial-flow type turbine.

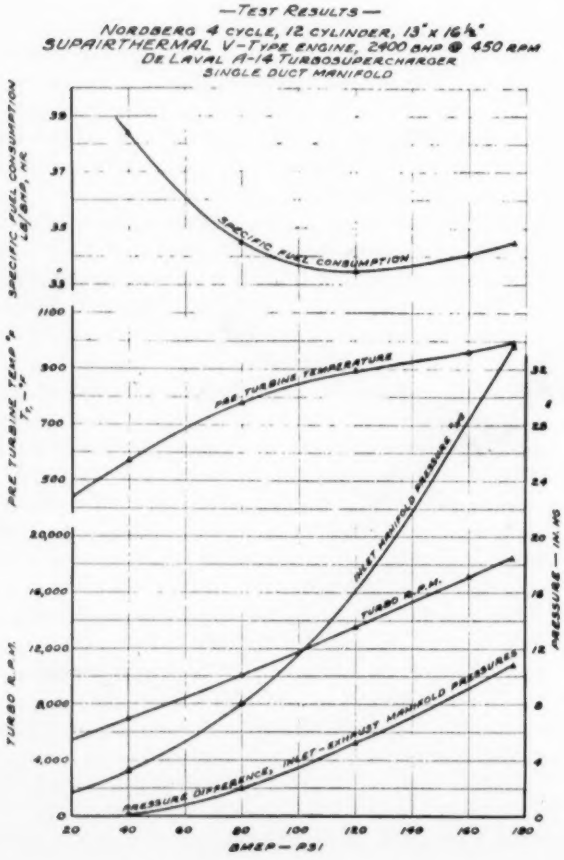
General Description ● This high-pressure turbocharger is generally similar to the conventional units in that it has the same components; the main difference is in the component design and the arrangements. The major components are the compressor volute case and the turbine volute case, separated by a water-cooled partition; the rotor assembly; and in the turbine portion, the guide vane and shroud assembly.

The impeller and the turbine wheel are incorporated in a single unit—termed the "Monorotor"—mounted on a shaft. The rotor is overhung and the shaft is journaled in two bearings located on the cold side of the rotor and contained in a common bearing housing that is an integral coaxial part of the compressor inlet casing.

Steel-backed copper-lead lined bearings are used. End faces of the outboard bearing are arranged to serve as thrust bearings in conjunction with thrust collars carried



The view above shows the turbine volute casing with the water cooled partition in place. In the illustration at the upper right, the partition has been removed and the rotor inserted to indicate its position relative to the guide vanes. Blading at the near end would be on the compressor side of the partition in actual operation.


—TEST RESULTS—
NORDBERG 4 CYCLE, 12 CYLINDER, 13" x 16½"
SUPAIRTHERMAL V-TYPE ENGINE, 2400 BHP @ 450 RPM
DE LAVAL A-14 TURBOSUPERCHARGER
SINGLE DUCT MANIFOLD
SPECIFIC FUEL CONSUMPTION
PRE TURBINE TEMPERATURE
INLET MANIFOLD PRESSURE
TURBO R.P.M.
PRESSURE DIFFERENCE; INLET-EXHAUST MANIFOLD PRESSURES
BMEP — PSI

on the shaft. This locates the rotor and provides for its slight axial thrust.

Bearings are readily accessible and can be removed for inspection in a few minutes. All that is necessary is to remove the bearing end cover. Lubrication is provided by the engine lubricating system or a separate self-contained system as preferred.

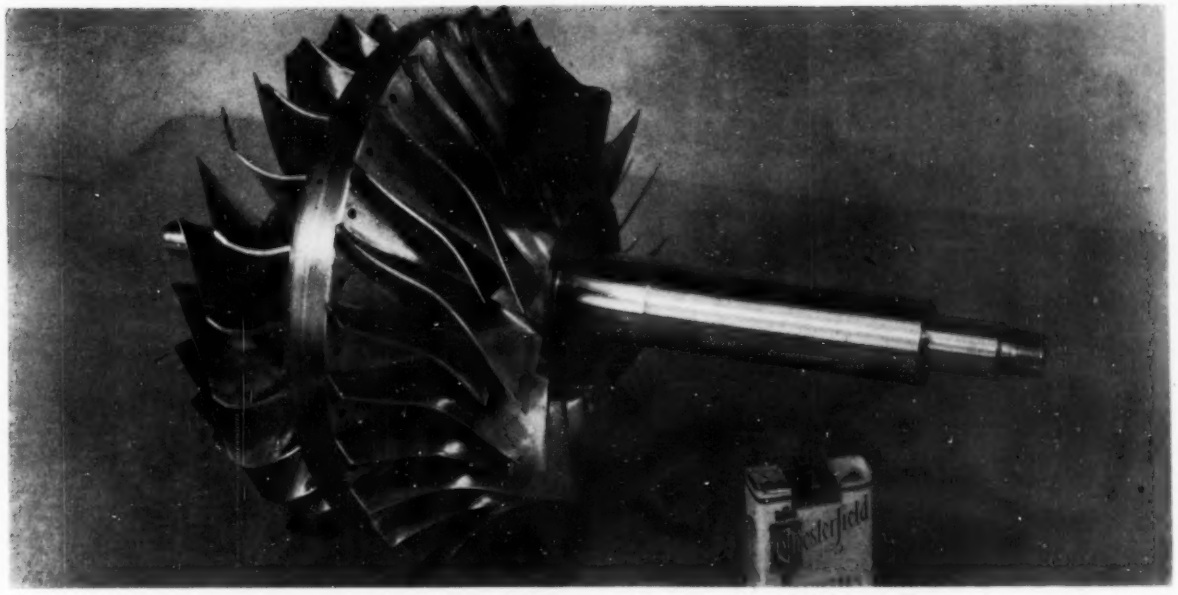
The Monorotor ● The mixed-flow impeller blading is carried on one side of the rotor hub and the centripetal turbine blading is mounted on the other. An attractive feature of this type of turbine blading is its ruggedness. The blades are strong and few in number in contrast to the many comparatively narrow and delicate blades of the conventional turbine wheel. Another feature of both turbine and compressor blading is that they are open along their entire tip contour. Their configuration prevents accumulation of dirt with its bad effect on performance.

The unitized arrangement of the rotor eliminates parasitic losses such as turbine and compressor leakage, windage, and friction of non-working surfaces. Thus, efficiencies are substantially improved over and above those inherent to the design features. This construction also has the advantage of extreme simplicity, eliminating many parts such as air and gas seals and partition walls.

Compressor Housing ● Air enters the housing axially, and is discharged by the impeller into a vaneless diffuser, which terminates in a scroll housing having a tangential outlet. The use of a vaneless diffuser is largely responsible for the wide compressor operating range. This makes the unit capable of serving efficiently various engines having different airflow requirements.

An air filter is mounted directly on the inlet flange of the compressor housing.

Turbine Housing ● Engine exhaust gases enter the turbine



The rotor's small size is more clearly indicated by its comparison to a package of cigarettes. Note rugged construction of turbine blading.

nozzle box in a tangential direction through a single inlet. The gases are directed into the turbine wheel by guide vanes arranged between two radial walls. The vanes are so mounted that they can be readily pivoted for changing the nozzle area.

This feature permits rapid matching of the turbocharger to the engine without the necessity for installing different nozzle rings as is the conventional practice. In fact, an externally-adjustable guide vane mechanism has been devised that permits adjustment during turbocharger operation. This mechanism is invaluable when used as a tool to perform rapidly a series of tests to provide the best matching of engine and turbocharger.

Exhaust gases are directed radially inward to the turbine blades where they are discharged into the passages formed by the blades of the turbine wheel. They then discharge into an exhaust diffuser that is coaxial with, and a part of, the heat-resisting alloy turbine housing. The diffuser is designed to recover some of the kinetic energy represented by the velocity of the gases upon discharge from the turbine blades. It also conveys the gases to the discharge opening.

Cooling ● Reliance is placed on insulation and lagging of the turbine housing rather than water-cooling. The turbine nozzle box is separated from the compressor housing by a central partition. This diaphragm is hollow for water circulation and is the only part of the unit that is water-cooled. Indicative of the small heat loss, tests have shown that the amount of heat rejected to the water is insignificant in comparison to that carried away in the cooling water of fully-jacketed turbine casings.

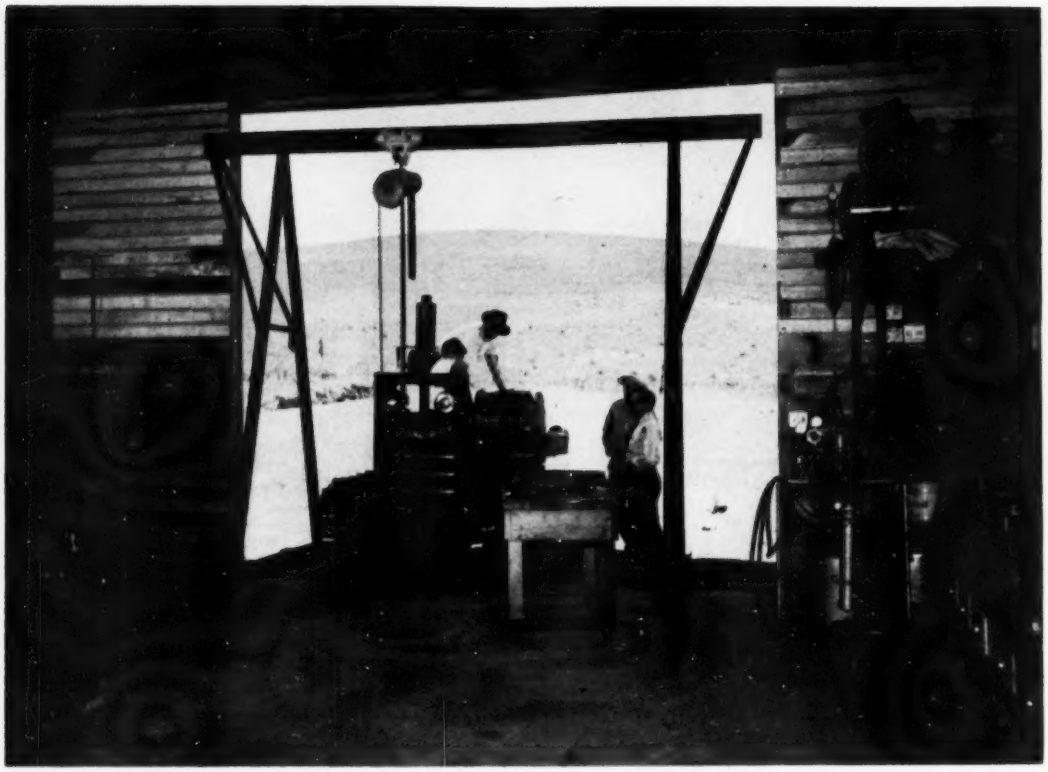
Internal cooling of the turbine side of the rotor is simply effected by bypassing approximately 5 per cent of the air handled by the compressor over the periphery of the rotor to the turbine rotor hub. This air flows in a thin sheet over the hub, blanketing it from the heat of the blades.

This cooling is augmented by providing airflow through the hollow rotor interior and through cooling passages directly adjacent to the turbine blade roots. The consequent reduction in metal temperature permits safe operation at the highest temperatures encountered in diesel service and greatly extends the life of the parts.

Operation ● The design of this turbine provides for full admission of exhaust gases, a necessary requirement if maximum turbine efficiency is to be achieved. In earlier systems, having divided manifolds, full admission is not possible. Because of the separate discharge into groups of turbine nozzles, partial turbine admission (momentarily, at least) and pulsating flow are obtained, both adversely affecting turbine efficiency.

The DeLaval turbine operates with full admission and steady flow at all times, and to recover the pulsating portion of the exhaust energy a pulse converter adapter is used. This adapter piece connects all the branches of a divided manifold to the single turbine inlet. A system of nozzles discharging into a common diffuser—all contained in the pulse converter adapter—causes the pulsating portion of the exhaust-energy to be converted into a pressure rise so that the pre-turbine pressure is higher than the mean pressure in the exhaust manifold. The differential between these two pressures represents the portion of the pulsating energy that is utilized.

The total energy—mean exhaust manifold pressure plus the portion of the pulsating energy recovered—is applied to the turbine under conditions of steady flow and full admission. The efficiency of the components then serves to convert this energy into a maximum net output. In this way, the advantages of high-pressure turbocharging can be more fully realized.



Palouse farmers think of diesel power in terms of higher production and more efficient farm mechanization.

Diesels in the Palouse

By Robert H. Forbes

OVER the past decade, a diesel-powered revolution has swept the rich wheat farms of the rolling Idaho-Washington Palouse country. To quote Professor James W. Martin, head of the University of Idaho's department of Agricultural Engineering, "nearly 100 per cent of the tractors used in planting, cultivation, and harvesting on Palouse farms have diesel power".

The revolution, together with the farmers' wide realization of the wisdom of soil conservation practices, has increased the production of wheat to feed the hungry world. Grain-elevator-storage facilities at Genesee, Idaho were increased by 270,000 bushels last year, a short five years after storage at Genesee had been upped by 290,000 bushels in 1947.

In the 14 years from 1929 to 1942, farms around Genesee shipped an average of 50 million lb of grain annually. Then diesel equipment and soil conservation boosted the average to 69 million lb for the period from 1942 to 1952—an increase of almost 40 per cent.

This land revolution has radically changed the lives of Palouse farmers who have now adopted the role of mechanic along with their agronomical skills. Most convincing evidence of the new interest is the number of spacious well equipped farm shops which dot the countryside.

Single-vehicle garages with a single workbench are far too restricted in space and equipment for modern Palouse farmers. Their shops should be designed to house their largest piece of equipment, generally an 11- or 12-ft wide combine harvester, with at least 4 ft of working space on all sides. Doors too must be of ample size to accommodate the machine's height.

"Outside dimensions of 24 ft by 36 ft is a suggested minimum size for a grain farmer's shop," states William H. Knight, Farm Electrification Project leader at the University of Idaho, who has made a special study of the subject. "A door 11-ft wide and 12-ft high is about minimum too."

Concrete floor, wooden frame, corrugated metal siding and roof, is the most popular type of Palouse farm shop construction. A liberal apportionment of window space, about one-quarter of wall area, and walls of a light color should be included in plans. The last is recommended because the greater share of farm maintenance work will naturally come during the gloomy days of winter.

Wintertime work in the farm shop also calls for sufficient heat, most conveniently furnished by a home-made, double-drum oil stove suggested by the Washington State Agricultural Experiment Station. The station is headquartered at Pullman, Washington in the state's portion of the Palouse area.

Such stoves are easily made from two discarded 50-gal drums supported so that their rounded sides are one above the other, with a regulation stove pipe leading from the top drum, a short length of stove pipe between openings in the sides of both drums, and a fuel oil adapter in the bottom drum. Heat radiation into the shop thereby takes place over twice the surface of a single drum.

Ample electrification of shops for ease in handling repair jobs is urged by Professor Knight. He is particularly quick in recommending adequate artificial illumination to supplement natural light or for work at night. "One ordinary ceiling lamp of at least 100 watts should be provided for every 200 sq ft of floor space," he says, "and an additional 100-watt light should be installed over each permanently placed piece of equipment. Another 100-watt light for each 8-ft length of workbench is also advisable," he concludes.

A near-minimum number of larger tools found in Palouse farmers' shops includes: drill press, acetylene and arc welder, welding table, air compressor, anvil and forge, portable and stationary grinders, overhead crane, and workbench with vise and smaller tools. The last are most easily kept on wall mounts with tool outlines painted in red by hanging on permanently assigned hooks or by securing in clips.

No Palouse farm shop is so complete, however, that it contains equipment for complete diesel maintenance. Dealers of the area provide trouble-shooter trucks for diesel service as well as for infrequent major repairs. The Everett Will Tractor Company of Moscow, a local caterpillar dealer, offers the only bench for testing and adjusting "Cat" fuel pumps and nozzles in the Palouse area. The company handles 500 to 800 units a month, the largest number in the spring of the year when a season's work on wheat farms is beginning.

Standard Caterpillar test apparatus at the Moscow company's shop will take care of two basic pump models in all three sizes, according to the manufacturer's latest specifications. The apparatus consists of a stand, discharge testing assembly, unseating pressure calibrating valve, and screened box to catch the diesel fuel spray used in a test. Spent spray is then returned from the screened box to a reservoir.

Injection-testing apparatus is well isolated from the rest of the repair shop in a separate room between floor levels. Diesel injection equipment is thoroughly tested and overhauled according to the manufacturer's specifications. Each pump or nozzle is tagged to indicate condition.

The Will shop is also kept busy with equipment repairs too large for the average farm shop. It contains, for example, an electric impact wrench, 70-ton hydraulic press, and a steam jenny. An electric wrench can speed the job of removing tractor shoe plates. Shop machanic, Bill Morton, estimates that "demounting the shoe plates of a D-4 tractor would take one man a good 24 hours of hand labor. The impact wrench allows one man to do the job in four hours. I have seen three men completely dismount the plates in one and one-half hours with the automatic wrench."

Each year, as the spring farming season approaches, Palouse equipment dealers conduct one-day schools for customers. At the schools, farmers are brought up to date on developments in diesel equipment, shown the latest soil conservation movies, given valuable tips on tractor maintenance, and called upon for pressing personal mechanical problems.

To further illustrate what these equipment dealers are doing to help their customers, let's look in on a school

On the Hagedorn farm near Moscow, Idaho, Bill Jones, parts man for the Will Company, prepares to weld track carrier rollers.

Bill Jones gets around. Here he is in the shop of the Jorstad farm near Pullman, Washington.

session sponsored by the local Cat dealer. Here, topics are presented by local service men and district engineers from the factory branch in nearby Spokane, Washington.

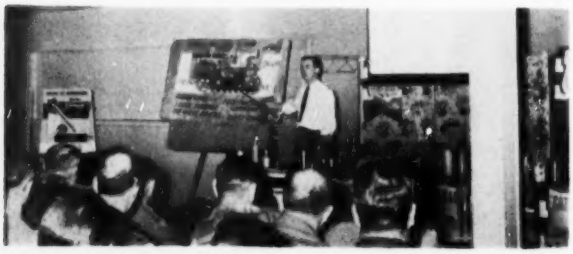
On March 5, 1953, a Chamber of Horrors display was assembled by Ray Bessler, a factory service representative. Exhibits of faulty engine management for the display did not require too much searching, Ray claimed, which led him to think that many farmers are not taking their instruction manuals seriously.

One example was a clutch plate which cracked at the grease groove due to improper lubrication. Several dirty air cleaners, which would cause excessive ring wear, were also displayed on the Chamber of Horrors table. Almost an hour was spent in emphasizing operator's manual stress on "dust devils" in diesel tractors. Past experience has shown Ray that this phase of good machine management is all important and apt to be taken too lightly.

The session was rounded out by talks on cost records, the parts situation, lubrication, and filters, given by company employees.

A view from a side hill on the Moore farm near Moscow, Idaho gives some idea of the hilly nature of the Palouse area.

The diesel tractor above is resting on a concrete apron in front of the shop—a handy place to knock mud and dirt off equipment.



Almost an hour was spent by Roy Bessler in pointing out the places were "dust devils" can cause excessive wear.

What Do You Know!

Test your knowledge of the various phases of the diesel field by selecting your answers to the questions below. Then turn to Page 88 to check them.

1. The gas turbine is a modern invention.
   a. True
   b. False

2. The output from a gas turbine increases under certain conditions. Which of the following conditions apply?
   a. Increases as ambient temperature decreases
   b. Increases as ambient temperature increases
   c. Increases as atmospheric density decreases
   d. Increases as atmospheric density increases

3. A controlling factor in gas turbine power output is:
   a. The amount of fuel that can be burned
   b. Temperature of the air entering the combustion chamber
   c. Temperature limitations of the materials used
   d. Pressure of the air entering the combustion chamber

4. High-pressure turbocharging is mainly dependent upon:
   a. High efficiency of turbocharger components
   b. Utilization of all possible exhaust energy
   c. Maintenance of relatively high differential between intake and exhaust manifold pressures

5. Nordberg's *Supairthermal* principle can be applied only to engines operating on liquid fuels.
   a. True
   b. False

6. One of the principal differences between the *Supairthermal* design and conventionally turbocharged engine is:
   a. Higher supercharging pressure
   b. Use of an aftercooler
   c. Provision for variable inlet valve cutoff

7. An important factor in the use of diesels on fork-lift trucks, particularly in work on docks, is the safety factor. With the high flash fuels, units may be stored and refueled right on the docks.
   a. True
   b. False

8. Because of the safety factors in gas pipeline pumping, engines in this service must be continually attended to insure proper operation both in the station and with respect to the pumping function.
   a. True
   b. False

9. Farm Electrification Project leader of the University of Ohio has outlined desirable features for farm diesel repair shops. One of the most important is:
   a. Type of construction
   b. Lighting specifications
   c. Suggested methods of heating

New Type Hangar Diesel-Powered for Atomic-Age Getaway

Billed as the "Navy's answer to sneak attack", the mobile pull-apart hangar is seen closed. This is the earlier model that runs on tracks and is diesel-electric powered.

WHEN you need an interceptor, you need it fast. This precept is the thinking behind the Navy's interest in a pull-apart hangar. Tests of a completely self-contained unit featuring this design were conducted recently at the Marine Corps Air Station at Cherry Point, North Carolina.

The giant clamshell consists of two 55-ton triangular steel shells, and in the first version was mounted on six 18-in steel wheels running on tracks. Electrical power for separating the two halves was provided by a diesel-generator unit.

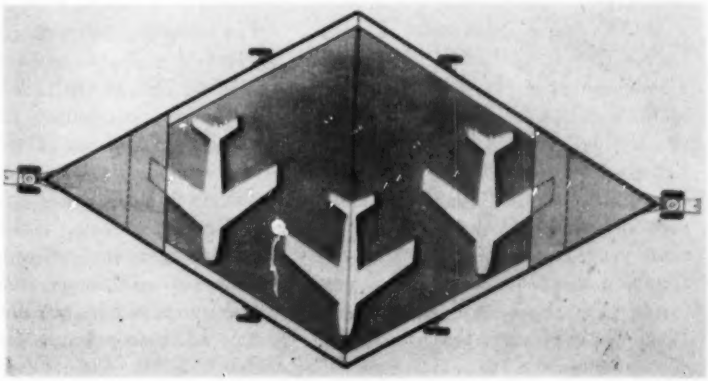
A new model affords greater mobility as it is mounted on rubber-tired wheels with each half being propelled by a LeTourneau traction unit. The latter are the diesel-electric Tournatows featuring independent DC traction motors driving each wheel. Steering is also electrical and is handled by AC motors.

With the new setup, the hangar can move around the air base freely at the desire of the control tower. Three jets can be accommodated, and they will be completely freed to take to the air in a minimum of time.

The design is the work of the Mitchell Mobilehangar Corp. of New York and was approved for test by the Navy. The equipment division of the Navy Bureau of Aeronautics is reportedly well satisfied, a feeling shared by the skipper of the jet squadron used in the tests.

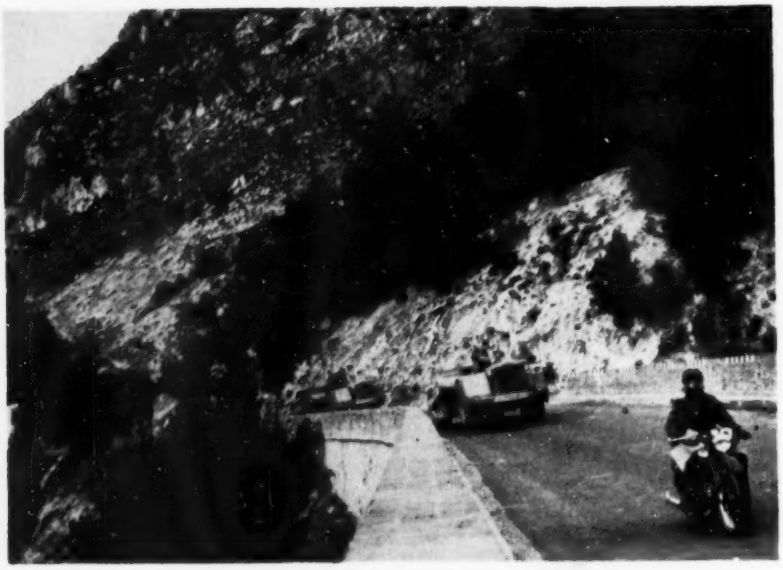
When the power is applied, the two halves separate to give free exit to the enclosed airplanes. Those seen with wings folded are not placed as for tactical usage.

Phantom view of "free-wheeling" hangar mounted on rubber tires and powered by two LeTourneau traction units. The wheel mounting permits a great degree of mobility.



Text and pictures through the courtesy of STEELWAYS, *published by the American Iron and Steel Institute.*

DIESEL BRIEFS



Seeing Italy the Hard Way

Seeing Italy from the open seat of a DW21 Cat earthmover with the thermometer reading 20°F, isn't the recommended fare for tourists. However, it does offer an opportunity for one to see a lot of the countryside.

In two separate trips, field engineer Ken Rogers of Cat's export department saw almost the full length of the Italian boot from the seat of the rubber-tired tractor. Total mileage of the trips, which took him as far south as Naples and as far north as Trieste, was close to 1400.

The twofold purpose of these trips was to oversee the transportation of the large 24-ton units from the point of embarkation to their ultimate destinations, and to take advantage of the long drives to teach the Italians how to operate the machines.

Long-distance touring in these big open seaters leaves much to be desired, particularly under the circumstances encountered on the first trip. The convoy of two DW21's, a car carrying relief drivers, and the motorcycle police, drove through rain and snow which made the mountain roads treacherous. Note mask on policeman, protecting him from the 20°F temperature.

Canada RR Diesel Market—Good

D. W. Fraser, chairman, Montreal Locomotive Works, Ltd., in a recent announcement disclosed that he anticipated a substantial market for diesel-electric locomotives and parts in Canada for many years to come. Mr. Fraser remarked: "The CNR states that continued improvement in freight train performance resulting from increased use of diesels was the most notable feature of CNR operations in 1952. The CPR says that it will buy 358 diesel units in the next five years."

Lubricant Study at EMD

The search for better lubricants and lubricating methods has led the Electro-Motive Div. of General Motors to install a modern electron microscope capable of magnifying oil and grease particles about 20,000 times. The instrument, it is said, will be of great future value in helping customer railroads determine what effect lubricants will have on engine operation.

The instrument has an illuminating system of electron beams focused by magnetic fields. A 50,000-v electron gun, with a tungsten filament, produces beams at the top and directs them down. A built-in camera takes pictures and develops them in 2-in-sq size on a glass plate.

Australia Uses Small Diesels

The importance of the small diesel for the powering of farm machinery, pumps, elevators, circular saws, and other similar uses, is recognized in Australia and in recent years expanded production has been a feature of factory output.

For the 1952-1953 year, Australia produced 3035 engines in the 2-hp to 6-hp class, an increase from the 2619 of the previous year. These types are used exclusively for other than marine purposes, the production of marine engines being 1742 in this hp class. Marine diesels of all horse powers for the year totaled 2118 and for other than marine, 4280.

Diesel Operators Institute

The Third Annual Diesel Operators Institute, sponsored by the Dept. of Mechanical Engineering of the University of Kansas, was held recently.

Major subjects discussed were: the Nordberg radial engine; vapor phase cooling; corrosion problems in diesel cooling systems; and overhaul procedure. The program included representatives from Nordberg, Fairbanks-Morse, Worthington, Great Lakes Pipe Line, Service Pipe Line, Santa Fe Railroad, Illinois Testing Laboratories, American Locomotive, Standard Oil and others.

Museum Gets Miniature RDC

Visitors to the transportation section of the Boston Museum of Science may now trace railroad progress from the "Tom Thumb", first locomotive built in America, to the latest thing in passenger service. The Budd Co. of Philadelphia presented it with a handsome operating scale model of a self-propelled rail diesel car.

DIESEL BRIEFS

English Tractors To Be Diesel

Tractor production at the Ford Motor Co., Ltd., England will be mostly diesel, it has been announced, because of increasing demand for that type above gasoline and kerosene models. Selling price for the diesel is only about $275 higher than the other models.

The British tractor is larger than the American counterpart gasoline tractor and has six forward and two reverse speeds against the American's four forward and one reverse. It weighs 4420 lb and is 130½-in long, 65-in wide, and about 57 1/3-in high. Germany had previously been Europe's largest producer of diesel tractors before Ford's decision to go diesel.

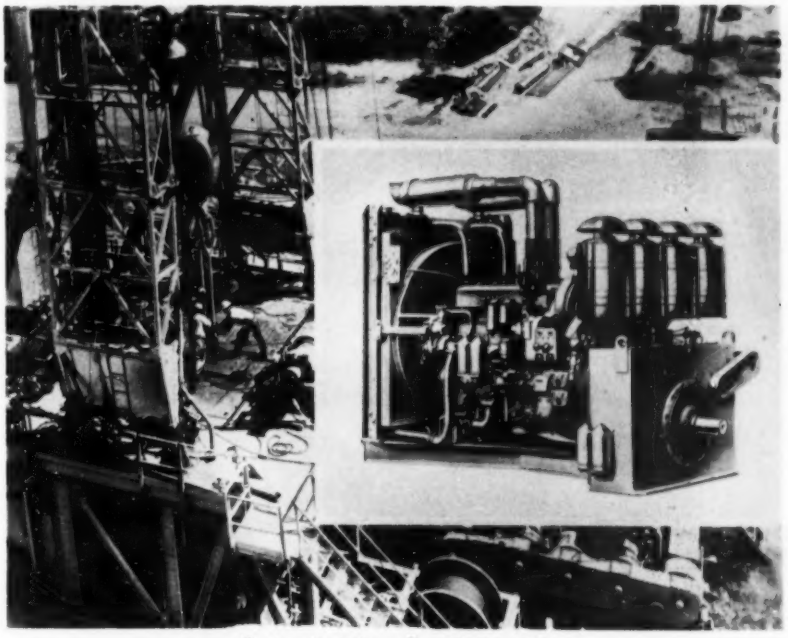
Westinghouse Air Brake Buys LeTourneau Earth-Moving Assets

Westinghouse Air Brake Co. announces purchase of the earth-moving and related business of R. G. LeTourneau, Inc., including all fixed assets and machinery at Peoria, Ill.; Toccoa, Ga.; and its interest in the Australian subsidiary.

The new business will be operated as the LeTourneau-Westinghouse Co., a subsidiary of Westinghouse Air Brake. No change in personnel is contemplated and all key executives will remain with the new company. The Vicksburg, Miss. and Longview, Texas plants will remain with R. G. LeTourneau and will manufacture products not related to earth-moving.

Penn Controls Extends Tour

A new series of educational shows, sponsored by Penn Controls, Inc. as a service to heating and refrigeration engineers and servicemen, has begun touring the Mid-western states. The specially designed show, which has been traveling through the western states, includes in the elaborate equipment giant controls which actually operate, colored slides, charts, and operating systems demonstrators.



Detroit Diesel's Twin-Six

GM's Detroit Diesel Division recently exhibited this Twin-Six diesel for the first time at the International Petroleum Exhibition in Tulsa. A newly designed GM torque converter is an integral part of each of the engines which make up the unit.

The engine, available with or without torque converter drive, is Detroit Diesel's answer to the drilling industry's demand for greater power in a relatively small package, according to E. F. Bentley, general sales manager. While the engine develops 505 hp without torque converter drive at 1800 rpm, it still maintains the low power-to-weight ratio characteristic of the 2-cycle engines.

Torque converters used on this model are designed to permit the release of either engine from the load simply by dumping the torque converter oil into a sump tank. This is accomplished instantly without the use of friction clutches. The chain case of the engine compound serves as the temporary oil container when this is done.

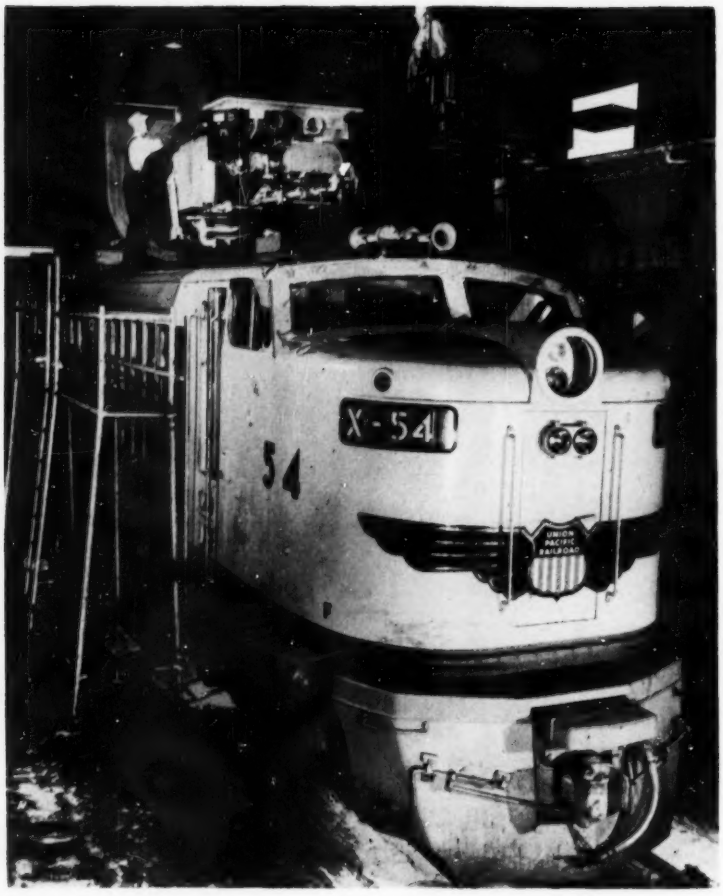
Diesel Power Plant Conference

Plans for the Fourth Diesel Power Plant Conference to be held at Iowa State University from July 20-22 include a program built around suggestions offered by operators who have attended previous conferences.

The following subjects have been scheduled with more to be added: piston ring installation and maintenance; session on indicator cards to be followed by demonstration on engine in laboratory; discussion and demonstration on effect of additives in lubricating oil; panel on maintenance of accessories; and, a full day on governors including half-day on teardown.

Clark Buys Ross Carrier

Clark Equipment Co. has formally acquired all the capital stock of the Ross Carrier Co., it was recently learned. Michigan Power Shovel Co., a subsidiary of Ross, is included in the transfer. Manufacturing operations will be continued at their present locations.



A GE gas turbine unit being installed in one of Union Pacific's road locomotives at the Green River, Wyoming shops.

A roundup of developments and current thinking as applied to the gas turbine for railroad use. Experiences of manufacturers and a user, provide a commentary on its potentialities.

Gas Turbine-Electric Locomotives— A Progress Report

GAS turbine-electric locomotives, their development and performance, were discussed in a presentation by Mr. D. S. Neuhart, General Superintendent, Motive Power and Machinery, Union Pacific Railroad, before a recent meeting of the Pacific Railway Club. This paper, along with interesting and important commentaries by others who were present and supplemented by some additional details, is the basis for this article.

Contrary to common opinion the gas turbine is not new. It has a longer history than any internal combustion engine. While it is said that the date of the first gas turbine is unknown, there is record of a toy with moving parts operated by the gas turbine principle built by Hero of Alexandria, Egypt, in 130 B.C. It was not until 1791 that an Englishman named Barber conceived the idea of drawing in and compressing atmospheric air, adding heat by the direct burning of fuel in the compressed air and then using the hot compressed gas to perform work as it expands to atmospheric pressure. This is the principle of gas turbines today as well as of modern jet engines.

This source of power, therefore, is not unlike that of gasoline or diesel engines except that in a gas turbine the air is compressed, fuel burned, and the expansive forces of the hot gases utilized by turbine rotors which provide a constant flow of energy. Reciprocating and many associated parts are eliminated. In early gas turbines, the air compressors required so much energy that little was left for useful work. However, in 1905 a commercially practical machine was built in France.

Experiments were continued with compressors, intercoolers, heat exchangers or regenerators, combustion chambers, and the many cycle arrangements possible in a gas turbine power plant. About 1938, the Brown Boveri Company of Switzerland produced a 4000-kw machine employing the open cycle arrangement generally used in the present-day locomotive gas turbines. In 1941, Brown Boveri turned out the world's first locomotive powered by a gas turbine, substantially of the same type as used successfully in previous stationary installations. This was a 2200-hp passenger locomotive.

Later, Brown Boveri delivered (early 1950) a very similar 2500-hp locomotive to the British Railways, and the British themselves recently completed a 3500-hp gas turbine locomotive utilizing the knowhow gained from their developments in the field of jet engines.

Our Developments

During recent years, several companies in this country have been active in this field. America's first gas turbine-electric locomotive was developed and built by the General Electric Company and first tried on its test track at Erie, Pennsylvania, late in 1948 and early in 1949.

After some preliminary road trials, during the first half of 1949, on portions of two eastern railroads (close to home), it was consigned in July of that year to the Union Pacific for extended operation and testing in actual freight service conditions at the extremes of temperature and altitude prevailing on that property. This pilot locomotive (No. X-50) was powered with a gas turbine rated 4500-hp input to the generators. With low ambient temperatures and altitudes the power plant would produce 5400 hp.

Effect of Temperatures and Altitudes

Concerning this subject, Mr. Neuhart observed: "An interesting phenomenon with gas turbines is that the output increases in direct relation to the decreases in temperature and altitude. For example, with a gas turbine having a nominal rating of 4500 hp at 1500-ft altitude and 80°F ambient temperature, there will be a theoretical increase of about 300 hp for every 10°F drop in temperature up to the maximum capacity of the power plant. A similar situation holds true with variations in altitude. However, railroads seem to have a habit of not adhering to theories and the variations in the horsepower because of temperatures and altitudes have not been as noticeable in actual train handling operations as the slide rule experts say they should be".

Some Results of X-50 Tests

The X-50 accumulated in excess of 100,000 miles in representative services including 95,000 miles in revenue freight service, producing 345 ton-miles. It burned 1,500,000 gal of fuel oil of which 95 per cent was Bunker C oil, operated in temperatures up to 120°F and at altitudes up to 8000 ft, and performed a short period of service on the Southern Pacific for which no special records were kept. After this the X-50 was returned to the builders at Erie, Pennsylvania, in June 1951, for further study and salvaging.

In a paper presented before the Northwest Locomotive Association some months ago, Mr. R. A. Williamson* of General Electric, called attention to the fact that the average train for the X-50 was about 3500 tons, while approximately 3000 tons was average for all 3-unit diesel-electric freight locomotives on the Union Pacific. These figures were mentioned to show that the X-50 was not "babied", rather than as a direct comparison which he considered would not be fair.

In reviewing things learned in the two and one-half years of operation of the X-50, Mr. Williamson called attention to several important items. The locomotives instead of being slippery and hard to handle, as had been predicted by some experts, actually acquired an enviable reputation for being just the opposite. It was called "Old Glue Foot" by some of the men.

Reasons for slippery predictions were based on its hp per axle which at continuous rating was 562 and at maximum output 675. This compares with a 500 limit, generally accepted, beyond which locomotives become slippery. Presumably, according to Mr. Williamson, the X-50 did not slip because of the combination of the 20-notch throttle, arrangement of traction circuits, and running gear characteristics.

Operating cabs at both ends were found to be unnecessary as its 83½-ft length permitted turning on available turntables. A significant saving in turbine fuel resulted from discarding the direct-driven air compressor (from turbine shaft), and installing two motor-driven compressors. This arrangement permits locomotive hostling movements using power from an auxiliary diesel engine-generator set connected to a pair of traction motors. Also, it allows for pumping up and testing train brakes without operating the turbine as well as at other times when main turbine power is not needed.

According to Mr. Neuhart, the performance of the pilot locomotive with respect to its ability to handle trains satisfactorily and to utilize all available horsepower, together with the potential economies in both operating and maintenance costs, seemed promising to such an extent that 10 production locomotives were ordered early in 1951.

An experimental Westinghouse gas turbine-electric locomotive in freight service.

**Mr. Williamson is manager, Railroad Rolling Stock Division, Locomotive and Car Equipment Department, Erie, Pennsylvania.*

Some Details of the Ten

Essentially, these locomotives are of the same design as the pilot unit except for the incorporation of numerous improvements and modifications dictated by experience with the X-50. Some changes were in power plant arrangement and controls to provide for more nearly automatic operation. This eliminated necessity for a power plant engineer as required on the X-50 which was something of a traveling laboratory.

The gas turbine power plant is a single-shaft straight-through machine that takes air in at one end and runs it through a 15-stage axial flow compressor discharging into six combustion chambers. The combustion gas then passes through a 2-stage turbine and out through the exhaust duct in the roof. The main turbine is connected to a reduction gear about which are arranged four traction generators. Each drives a pair of traction motors.

The locomotive, weighing about 551,000 lb in working order, is carried on eight pairs of 40-in wheels all powered by conventional traction motors. Nominal hp is 4500, with a continuous tractive effort of 105,000 lb at 12.9 mph. Maximum speed is 65 mph with 74:18 gear ratio.

A 250-hp diesel engine-generator set is provided to bring the turbine up to the firing speed of about 700 rpm accomplished by motoring one of the main generators. Diesel fuel is used to start the turbine power plant and bring it up to about 4500 rpm. The diesel engine drive then automatically disconnects and the turbine continues to accelerate to the normal idling speed of 5200 rpm. Changeover to Bunker C fuel is then accomplished by positioning a turbine control switch located in the operating cab.

The main fuel tank has a capacity of 7200 gal. The theoretical fuel consumption rate is from 200 gph at idle, no load, to about 600 gph at full throttle, full load. Fuel in the main storage tank is maintained at a temperature of 110°F by means of a conventional steam generator and heating coils in the tank. Fuel temperature is raised by heater before the oil passes through filters to the fuel pump which it reaches at about 240°F. Fuel filters are cleaned by steam, automatically by means of a differential pressure switch which is activated whenever the pressure drop across the filter exceeds 10 psi.

All necessary controls are located in the engineer's operating cab which is very similar to that of a diesel locomotive. After starting the steam generator and diesel engine at the terminal, it is not necessary for the engine crews to enter the engine room either to start the turbine or for operations enroute.

Type of Turbine Fuel

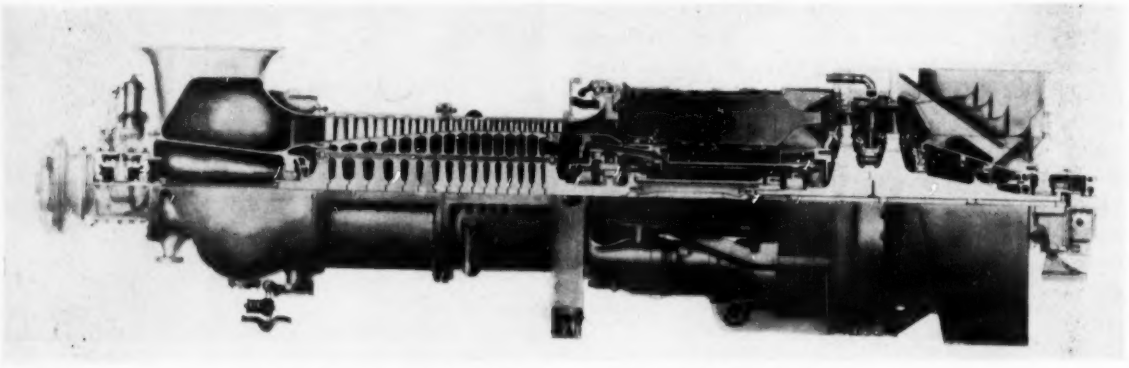
Production locomotives in service operate on heavy residual fuel. Through experience and extensive chemical and metallurgical research, it was found that an unbalanced ratio of vanadium, calcium, and sodium salts which may be present in mine-run residual fuel were detrimental to combustion chamber, nozzles, turbine blades, and other turbine parts.

Since the operating economy of a turbine is largely dependent upon its ability to use cheap fuel with a reasonable service life of component parts, the obvious solution in the present state of development was to provide a residual fuel of controlled specification by removing the excess salts and maintaining proper ratio of the remaining affecting properties. This problem was solved by cooperative efforts of an oil company and the locomotive manufacturer, with the result that a treated and controlled residual fuel oil is supplied at a price not out of line with the cost of ordinary Bunker C oil.

Operation Through Tunnels

Original apprehension about what might occur during operation through tunnels with respect to recirculation of exhaust gases has been allayed. The locomotives operate through numerous tunnels without difficulty (the longest being 6700 ft), and occasionally under severest conditions such as two turbines doubleheading. The locomotives are equipped with a deflector to direct the exhaust at a 30-deg angle rearward. It is the practice to operate the turbine at maximum of 6900 rpm when entering tunnels in order to set up a flow of air toward the locomotive since the angle of exhaust duct helps provide an entraining action.

Operation of turbine at maximum rpm when entering tunnels, however, is done as a precaution rather than as a necessity. In one instance, because of a damaged draw-



Longitudinal cut-away of a GE gas turbine for a 4800-hp locomotive drive.

bar, a gas turbine-electric locomotive was operated backward through a tunnel and handled its train without difficulty.

As to Noise

It is true that the air turbulence set up by the intake and exhaust results in considerable noise somewhat different from that of a diesel or a steam locomotive. However, it is rather unpitched, has no definite overpowering frequency, and may be described as having the soft tones of a pop valve on a steam locomotive which fade away at a short distance. Conversation may be carried on in normal voice in the cab and the comparative absence of vibration from the power plant is noticeable.

How Do They Compare with Diesels?

This is usually the first question in relation to performance and maintenance. It is rather a difficult question to answer since the similarity between the two ends with the electric propulsion equipment, which is practically identical on both.

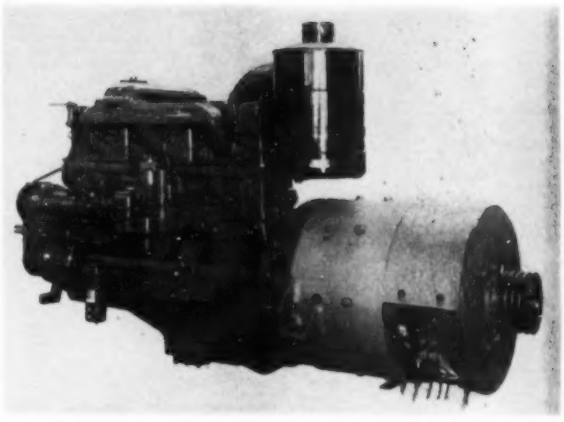
A gas turbine of 4500 hp in one unit has obvious advantages in servicing and maintaining as compared with a multi-unit diesel-electric locomotive. This is due to fewer component parts, less cleaning time, as well as the easing of many problems in turning and housing a shorter locomotive.

Unlike the diesel engine which may be idled at minimum rpm when power is not needed, the range of a gas turbine between idle and full power speed is small, and this is not favorable to fuel economy for some types of service. However, the turbine may be shut down when main propulsion power is not needed—as when standing, hostling, or drifting downgrade—when necessary operations are powered by the auxiliary diesel engine. Modifications to provide maximum use of dynamic brakes when the turbine is shut down are currently being studied.

Some Operational Data

Six of the production locomotives were received by Union Pacific from January to August 1952 and assigned in freight service mostly between Green River, Wyoming and Ogden, Utah. They took their turn in a pool with both diesel and steam power over this mountainous terrain which is 176 miles in length and has elevations varying from 4200 to 7200 feet. The locomotives have handled up to 5000 tons on the eastbound grade which for 65 miles out of Ogden is 1.14 per cent, the balance not exceeding 0.82 per cent; and 5600 tons over the 0.82 per cent ruling grade, westbound, without a helper. The locomotives have been well received by operating crews which consist of regular personnel.

Data for the six locomotives to January 1953 show a cumulative mileage of 437,771 with a current average of over 10,000 miles per month per locomotive. One, the first received, has made approximately 119,084 miles. Availability is better than 80 per cent, considered satisfactory for this territory. Fuel consumed averaged 13.99 gal of heavy oil and 0.85 gal of diesel fuel per locomotive mile, or 333.9 gal of heavy fuel per turbine hour. The diesel engine and steam generator consumed approximately 5.7 per cent of the total fuel consumed. A total of 6,541,147 gal was consumed during this period during which an average of 4.2 gal per 1000 gross ton-miles was obtained.



Auxiliary power for the GE gas-turbine locomotive is supplied by a diesel-electric generator set. In this case, it's a Model NHBIS-600 Cummins direct connected to a GE traction generator.

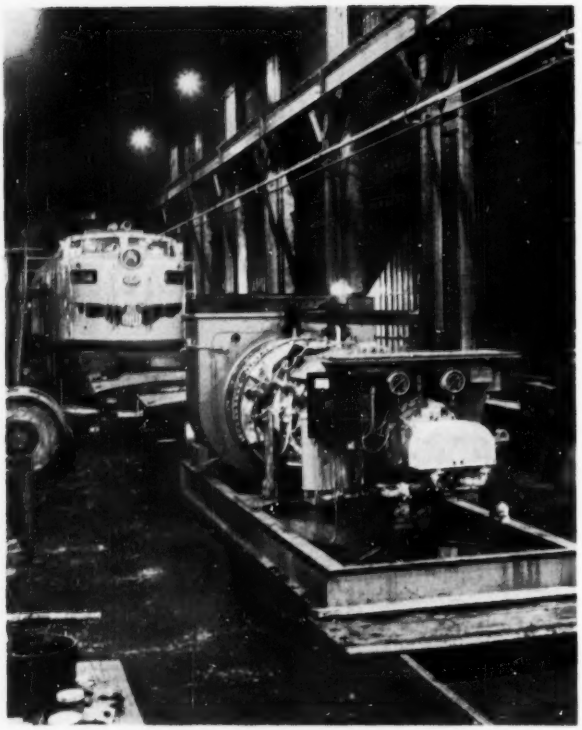
Operating economy depends upon the prevailing prices for the various types of fuel. In this particular operation it was found that cost of fuel consumed by the gas turbine-electrics on a 1000 gross ton-mile basis is comparable with that used by diesels and considerably less than that for steam locomotives. Gas turbine-electrics require less lubricants and other supplies that do diesel-electrics, also less servicing at terminals.

No repair cost comparison so far is possible between diesel and gas turbine-electric locomotives since the latter have not been in service a sufficient length of time. It is known that similar gas turbines in stationary installations have operated for long periods without being shut down for maintenance of any kind. While such operations do not present many conditions encountered with a locomotive, it is reasonable to expect that the long range repair cost will be less than for reciprocating engines due to the relatively simple design of the turbine and its fewer wearing parts.

A controlling factor in gas turbine power output is the temperature at which component parts can be operated for long periods of time without detrimental effect. It seems reasonable to assume that future progress will permit increasing gas turbine operating temperatures approaching the progress made with operating temperatures of steam turbines which have increased approximately 7 per cent per year through metallurgical improvements.

Summarizing as to Potential

All are familiar with the great strides made in improving diesel-electric locomotives a few short years ago. Research and developments in gas turbine-electric loco-



At Union Pacific's Green River, Wyoming shops a spare GE gas turbine unit assures high locomotive availability.

motives are being actively pursued by several builders including the practicality of burning powdered coal and gaseous combustibles, the use of free-piston compressors, utilization of waste heat boilers, and improved metallurgy. Some revolutionary developments may be expected.

Performance of the gas turbine-electrics in their present state of development has been sufficiently convincing to the Union Pacific so that the original order for 10 was supplemented with another order for 15 production locomotives at a cost of about $8 million. This was done because of their faith in the future of these locomotives for specific purposes and with the knowledge that only through pioneering and the demand for something better can progress be made.

Commentary

GE Feels Refinements Still Necessary

"There were many changes in the 10 compared to the first one. There will be many rather major changes in the 15 which will follow the first 10," explained Jack Wilson, Gas Turbine-Electric Locomotive Sales Engineer of General Electric.

"We think the basic improvement will be increased life, giving greater dependability and lower maintenance There will be some slight improvement in fuel economy, not what we are hoping for, not what we need, sometime in the future to make a completely successful locomotive of this gas turbine-electric. I can say there are many things we know which will give us the drastic improvements which Mr. Neuhart predicts and which we in General Electric predict.

"At the present time, we don't know how to make these changes. We know of them. We know how much they will help us but it is a question of time until we learn how to make them. I can say now that as soon as we learn how, we will do it and will come up with a locomotive even better than we have today."

Westinghouse Experimental Gas Turbine

Commentary by F. W. Beichley, Pacific Coast Supervisor, Westinghouse Electric Corporation, briefly covered a description of operating experiences and some of the things learned in the two and one-half years of experience with a 4000-hp gas turbine locomotive designed for passenger service. This unit is described as follows:

"The Westinghouse-Baldwin locomotive is a single unit, 77-ft., 10-in long and weighs 247 tons, loaded. It is carried on eight axles, all powered, and delivers 52,800 lb continuous tractive effort and 115,000 lb starting. Maximum speed is 100 mph. Twin gas turbine power plants are used, each rating 2000 hp, delivering power to the rail by the same type of electric transmission used on diesel-electric locomotives which is familiar to all. One turbine has a waste heat boiler to study recovery of exhaust heat.

" A new type of running gear also is used, consisting of four identical 2-axle trucks capable of moving laterally under the cab during track curvature movements. This same type of running gear has since gone into service on the 2-unit, 6000-hp ignitron electric freight locomotive developed by Westinghouse and Baldwin for the Pennsylvania Railroad.

"An auxiliary diesel engine-generator set provides power for hostling the locomotive, starting the turbines, and for other miscellaneous needs.

"Three distinct periods characterize operations to date. First, there was the shakedown cruise on diesel fuel, beginning in May 1950 on the Union Railroad and then on the Bessemer and Lake Erie in freight service—both of these operations were not far from the Westinghouse East Pittsburgh plant. Here, weaknesses in the turbine control system were discovered when a turbine blading failure occurred on one unit after experiencing temperatures of 1750°F in an abnormal operation. The locomotive however completed its run by operating six and one-half hours after blade failure. While out of service for blading renewal, modifications necessary for burning heavy oils were accomplished and extensive standstill load tests were made with various residual oils.

"Second, there was a period of hauling up to 7-car passenger trains and freight trains as heavy as 5000 tons on the Pittsburgh and Lake Erie in 1951. This service showed that some additional features were required on control and combustion apparatus, fuel handling, filtering, etc.

"Third was the period after modification had been made incorporating the things learned. The locomotive was

then readied for 60,000 miles of intensive service on three railroads:

(a) For six weeks beginning February 1952 this locomotive handled mail and express trains of 26 to 29 cars on the fast non-stop 131-mile run between Harrisburg and Altoona on the Pennsylvania Railroad. Schedules were equivalent to those of the fleet of fast passenger trains of that road. There were no train detentions for 55 trips;

(b) Next, operations on the Missouri-Kansas-Texas Railroad began by hauling a 3000-ton freight train from Parsons, Kansas to Denison, Texas. Then, the locomotive resumed passenger service between Denison and Parsons on a 550-mile daily schedule with an average of 11 to 15 mixed passenger and mail cars. Operation of this service was excellent for 101 trips;

(c) On September 3, 1952, service began on the Chicago and North Western handling important passenger and mail trains between Chicago and Elroy, Wisconsin on a daily round trip of 423 miles. This operation was particularly rigorous as the locomotive was not only assigned on a 7-day week basis but was required to handle its own trains to and from the Chicago coach yards. On this tight schedule an occasional roundtrip has to be missed for maintenance work, accounting for an availability of 87 per cent. Availability of the locomotive for its assigned runs on the other two roads had been 93 and 98 per cent respectively—averaging 93 per cent on the three roads.

"Fuel used on these three roads was mainly No. 6 residual oil—diesel fuel being used by turbines only in starting, purging the system before stopping, and by the auxiliary diesel engine.

"Reviewing the operating record for facts and things learned, we find:

(1) Schedules were met with margin for 300 assigned runs. The only six train detentions were due to things like oil and air leaks—not to gas turbine power plants—except for one 20-minute delay on the North Western, occasioned in picking up diesel fuel after nozzle clogging;

(2) Operation was successful on commercially available grades of No. 6 residual fuel of low ash and vanadium content without any special treatment of fuel during operations. Viscosity of oil was no problem when oil was heated to required atomizing temperature at fuel nozzles. Consumption of residual fuel averaged 0.55 gallons per car-mile on M-K-T and C&NW type service;

(3) Real progress was made in nozzle and combuster basket maintenance with life of the latter increasing from 150 to 750 hours. Nozzles were cleaned weekly;

(4) Turbines were examined and found in good condition at the end of service on the North Western, and ready for continued service;

(5) Elaborate inlet filters for the axial flow compressors were found unnecessary in prevention of fouling and blade erosion;

(6) Improved turbine room cooling, better ventilation of electrical apparatus, and more effective lube oil temperature control were developed and verified;

(7) Road service of present locomotive design showed that noise presents no special problems;

(8) A wealth of information on the maintenance man's problems was gained by Westinghouse engineers, resulting in improved access to parts like nozzles, combusters, filters, etc.—things important to the acceptance of all future units;

(9) Control innovations were proved effective in matching the electric drive to gas turbine characteristics and pro iding protection during speed changes and under high temperature conditions;

(10) The waste heat boiler proved practical for steam heat requirements in passenger service and for heating the fuel oil, making it a source of increased overall economy that will be recognized for this type of motive power;

(11) The new running gear exhibited superior riding and tracking characteristics and reduced flange wear.

"The experimental locomotive has accomplished the purpose for which it was intended. It has been a means of finding and then proving the solutions to problems as they arose. We are enthusiastic, and we are confident that the gas turbine has a place in American motive power. Laboratory days are over; we are now ready to put to use all these things we have learned."

Electro-Motive Has a Different Approach

A different note was sounded by Corliss A. Bercaw, Regional Manager, Electro-Motive Division, General Motors Corporation, San Francisco, who explained his company's line of thinking.

"Regardless of what we think now, economies will govern because that is what opens and closes the pocketbook. In contrast with the endeavor to develop a new type of locomotive, our whole effort is being put forward to protect the investment in the diesel locomotive as it is now built. At the turn of the year there were 13,334 units of diesel locomotives built by Electro-Motive, operating on rails; and of that number there were 6799 units of road power of 1500-hp capacity. It is to that group we are looking in order to protect the investment of the interested owners who are operating them. That amount of power represents something like $1,060,644,000 of money spent.

"To that end, I would like to read to you two brief paragraphs which express our forward policy as expressed by our general manager:

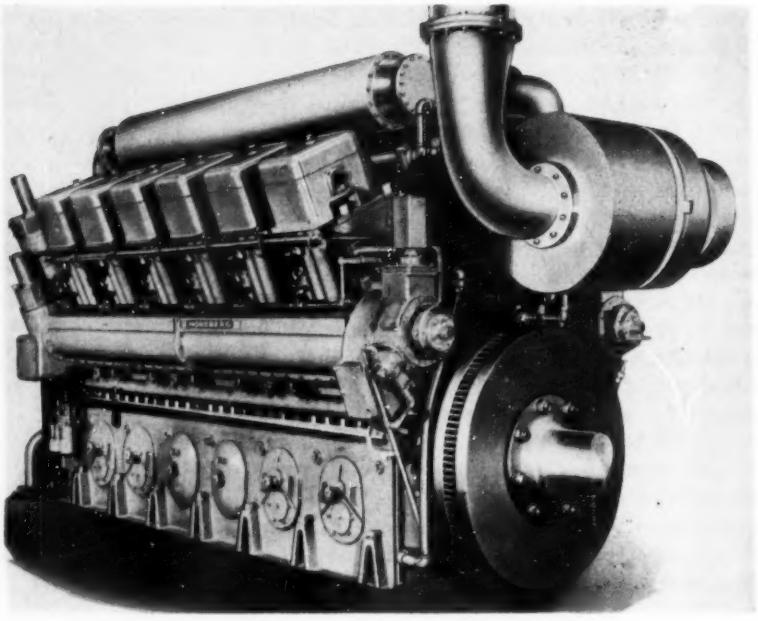
" 'Let the gas turbine develop firstly in the applications such as aircraft, power stations, and other applications where it has a natural advantage and then apply, so far as possible, this development to the locomotive.

"Protect the current investment in diesl-electric locomotives by concentrating development in the field of gas turbine locomotives on a power unit which will exactly replace the existing diesel engine prime mover. If and when the gas turbine can be made to show superior advantages and economy, the power unit alone, representing only say 20 per cent of the cost of the locomotive, can then be substituted for the existing engine.' "

Mr. Bercaw went on to say that a gas turbine has been built, strictly experimental in design, and it is at the General Motors Technical Center in Detroit. It was reported at the time as having a capacity of 1750 hp, delivered to the generators.

Nordberg's Supairthermal "V"

Features of the Supairthermal design were recently extended to vee-type engines when Nordberg announced production of a new series of 4-cycle turbocharged models.



DEVELOPMENT of the vee-type Supairthermal engine stems from the increasing demand for compact heavy-duty prime movers of moderate weight. This is another step in the Milwaukee firm's program to manufacture a wide range of efficient prime movers for stationary and marine service.

Before going on, it might be well to review briefly some of the features of the Supairthermal principle. The objective of the system is to obtain higher specific engine output without running into the excessive mean cycle temperatures that would normally be encountered.

This is accomplished by increasing the density of the air charge to the cylinder by higher turbocharging prsssures and by both external and internal cooling of the charge. External cooling takes place in an intercooler between the turbocharger outlet and the inlets to the cylinders. Internal cooling occurs in the cylinders. The inlet valves close early in the intake stroke, allowing the air to expand, and thus cool during the balance of the stroke.

The point of inlet valve closing is varied automatically, controlled by intake air manifold pressure, to suit the engine load. At low manifold pressures the time of valve closing approaches normal, while at high load cutoff occurs 45 deg early.

This process is illustrated and typical pressures and temperatures are given. The result is that while the bmep can be increased, the mean cycle temprature is directly comparable to that of ordinary turbocharging.

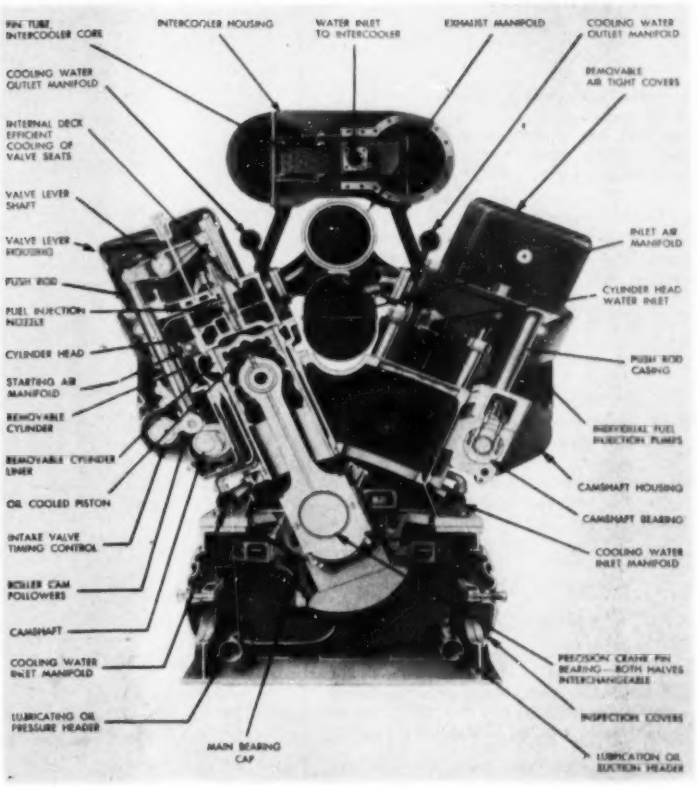
Performance features of the in-line Supairthermal engines are common to the vee-type units also. Vee-type models will be built in 12- and 16-cycle executions with a bore and stroke of 13 in by 16½ in, covering a horsepower range of 2400 to 4260 at speeds of 450 to 600 rpm. Interchangeability of parts between in-line and vee-type units is another feature which was carefully considered during the design stages. Many of the major parts are interchangeable.

Engines are also designed to operate on diesel, dual-fuel or spark-ignition principle. As a diesel, the engines can burn a wide range of fuel or crude oils. For dual-fuel operation, various types of gaseous fuels may be used with a small percentage of pilot oil. Should the gas supply be interrupted, the engine will automatically swing over to full diesel operation without affecting speed or load. As a spark-ignition gas engine, it will burn natural gas, butane, propane, manufactured gas and sewage gas.

From the cross-sectional view, the compact design and heavy construction of the engine can be seen. The included angle of the two cylinder banks is 45 deg and the offset between cylinders working on each crankpin is 4¾ in. Net weight of the 12-cyl engine is 96,000 lb and the 16-cyl unit, 122,000 lb. However, this does not include flywheel and extension shaft weight on stationary units or the weight of the flywheel, thrust bearing, or thrust shaft for marine engines.

General Arrangement

Rugged engine construction results from the application



At left, a 12-cyl model of the Supairthermal vee-type engine, rated 3200hp at 600 rpm. The cross sectional view (right) clearly illustrates the relation of the intercooler to the intake and exhaust manifolds.

of heat-treated alloy steels in the engine frame, bedplate, crankshaft, connecting rods and other parts. The compact frame is a rigid member of welded steel plate and is stress-relieved after fabrication. Heavy sections, between top and bottom cylinder compartment members and upper main bearing supports, transmit combustion forces directly to the top deck of the frame.

To provide maximum strength and rigidity to the entire engine structure, the crankshaft is carried in the frame and supported by the lower transverse members. Steel bearing caps, held in place by two through-bolts, are keyed to these members. The counter-weighted crankshaft is forged from a heat-treated alloy steel, and has drilled passages through the bearing journals and crank webs for pressure lubrication.

Simplicity of cylinder construction is another feature. Removable cast iron liners seat in individual cast iron jackets. This construction is designed to permit directed water flow for more efficient cooling. In addition, the entire cylinder assembly with liner is easily removable without disturbing the cylinder liner water seals.

For maximum cooling, intake and exhaust valves are seated directly in the cylinder head. Cooling water flows from the cylinder jacket to the cylinder head through accessible outside connections. This eliminates grommets and special gaskets. Cylinder head design also provides high velocity cooling water circulation around the valve seat areas.

Air inlet and single-duct exhaust manifolds are located directly under the intercooler housing. The two-pass type intercooler extends the full length of the engine. For stationary application the turbocharger is positioned on the free end of the engine, while for marine use it is mounted on the drive end.

Lube and Fuel Systems

Rotary-type lube oil pumps, chain-driven from the end of the crankshaft, pressure-lubricate all moving parts of the engine. Pressurized oil flows through strainers, filters and coolers to a header located in the engine bed-plate. From the oil header, individual lines lead to each main bearing cap, the gear compartments at each end, camshaft bearings, and valve levers.

Fuel systems have been designed to provide minimum maintenance and opimum efficiency depending upon the type of operation. For oil operation, a constant stroke fuel injection pump of the variable cut-off type is mounted on the camshaft housing adjacent to the cylinder it serves. Nozzle holders are located in the center of the cylinder head for ease of accessibility.

For dual-fuel operation, a hydraulically-actuated gas admission valve is mounted in the cylinder head. A similar valve is also employed with the spark-ignition system. In addition to this, the latter system uses two spark plugs per cylinder, low tension impulse generators, rectifiers, and transformers to assure dependable and complete combustion. Hydraulic relay-type overspeed and control governors are mounted at the flywheel end of each engine.

NORDBERG SUPAIRTHERMAL ENGINE CONVENTIONAL SUPERCHARGED ENGINE

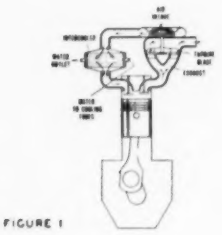


FIGURE 1

Fig. 1 The 3-lb. pressure difference between input to turbocharger and blower output provides high rate of scavenging air flow that removes exhaust gas and cools combustion chamber. Air enters cylinder at 15 psi. and 100°F.

SCAVENGING

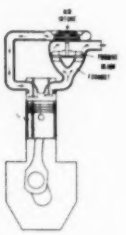


FIGURE 2

Fig. 2 By comparison, the 1¼-lb. pressure difference in a conventionally supercharged engine provides only moderate rate of scavening air flow.

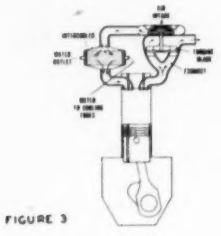


FIGURE 3

Fig. 3 Intake valve closes 45° before end of stroke. Air then expands to end of stroke.

INTAKE STROKE

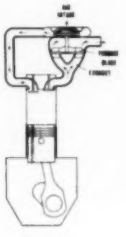


FIGURE 4

Fig. 4 By comparison, intake valve remains open till end of stroke.

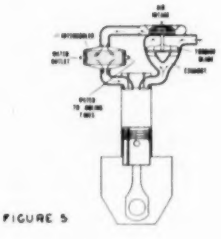


FIGURE 5

Fig. 5 Both intake and exhaust valve are closed. Air has expanded to 6 psi. and 50°F, providing additional cooling. Compression begins.

PISTON AT END OF STROKE

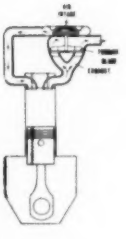


FIGURE 6

Fig. 6 Both intake and exhaust valves are closed and compression begins.

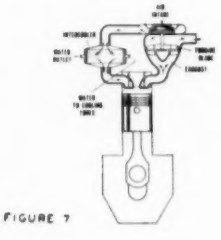


FIGURE 7

Fig. 7 Combustion chamber contains 30 per cent more weight of air than conventional engine. Temperature is 792°F; pressure- 648 psi.

END OF COMPRESSION STROKE

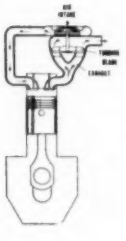


FIGURE 8

Fig. 8 Conventional combustion chamber contains air at 1010°F and 580 psi.

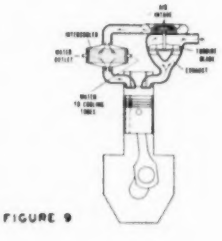


FIGURE 9

Fig. 9 Combustion continues through 10 per cent of stroke. Temperature is 3120°F; pressure- 850 psi. Expansion starts. Increased length of stroke through which combustion continues increases bmep.

BEGINNING OF POWER STROKE

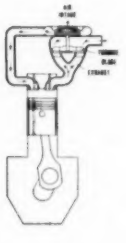


FIGURE 10

Fig. 10 Combusion continues for 6.7 per cent of stroke. Temperature is 3390°F; pressure-850 psi. Expansion starts.

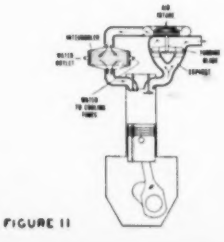


FIGURE 11

Fig. 11 Exhaust valve opens. Temperature is 1232°F; pressure- 62.8 psi.; mip.- 187 psi.

END OF POWER STROKE

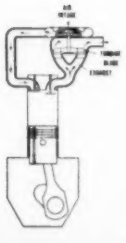


FIGURE 12

Fig. 12 Exhaust valve opens. Temperature is 1205°F; pressure- 43.2 psi.; mip.- 144 psi.

Diesel-Powered Towmotors

Towmotor Corporation has added diesel models to its line of fork lift trucks and industrial tractors to capitalize on diesel advantages.

A LITTLE over a year ago the first diesel-powered Towmotor went to work on New York City's waterfront. To get a comparative picture of diesel vs gasoline and electrically-powered fork lifts, A. A. Moore, Towmotor's New York distributor, selected stevedoring as the application for the new diesel unit. Of all the various fork lift applications, stevedoring is probably the hardest on this type of equipment.

In some instances, fork lifts may be worked around the clock to load or unload a ship's cargo. On the other hand, long periods of intermittent operation are frequently encountered.

Description

In general, outward appearances of a diesel-powered unit are the same as those of a gasoline-powered Towmotor. However, our main field of interest lies in the diesel prime mover.

At present, Towmotor is producing three diesel-powered models ranging in capacity up to 3½ ton. Power for these models is supplied by Continental diesel engines. The smallest, Model 480-P, has a 4-cyl Model GD-157 Continental diesel rated 21.5 hp for 80 bmep at 1000-ft piston speed per min. Bore and stroke are 3⅜-in by 4⅜-in, respectively. Maximum governed engine speed is 2000 rpm with maximum torque being developed at 1250 rpm.

In the larger, Model LT-60-D and LT-62-D lift trucks, a 4-cyl Model HD-260 Continental diesel is used. Rating for this engine is 28.4 hp at 80 bmep with a piston speed of 1000 fpm. As in the smallest model, maximum governed rpm is 2000. Bore is 3⅞-in and stroke 5½-in. Maximum torque is developed at 1100 rpm.

Common to both engines are: combustion chamber design, fuel injection equipment, valve arrangement, and full pressure lubrication system. The combustion chamber incorporates a "dyna-cell" which acts in several beneficial ways such as cushioning peak combustion pressures, which allows the use of cylinder liners having lighter walls. It also creates high turbulence in the combustion space thus permitting better air-fuel mixing, and momentarily stores energy which otherwise would be transmitted at greater force through the piston to the crankpin bearings when the crank is in a position near top dead center.

Model PSB Bosch injection pumps of the single plunger type are used. Governors are built integral with the injection pumps, which include a torque control feature.

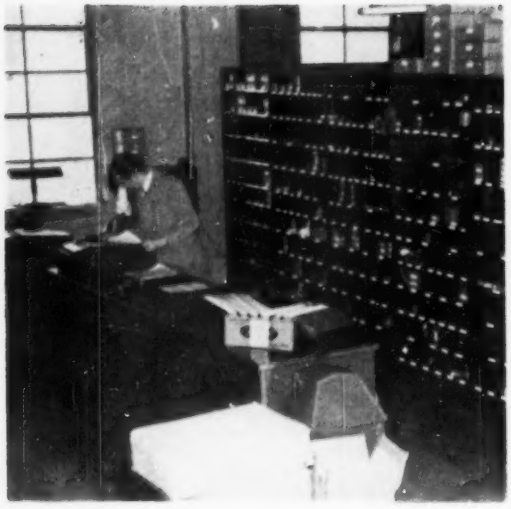
Economy and Safety

There are several economic advantages in operating diesel-powered fork lifts in this particular application. These are as follows:

1. Inherent economy of the diesel
2. Lower cost of fuel
3. Less out-of-service time
4. Lower insurance rates.

Here, as in other applications, the diesel's inherent economy represents a saving over gasoline operation. One stevedoring firm making an accurate check on fuel consumption, found the diesel-powered units were using .34 gal per hr or operating 3¼ hr per gal of fuel. Comparable figures for gasoline units are not available, but an overall fuel consumption rate for gasoline powered units presumed to be of different sizes averaged out at 1¼ gal per hr.

On the basis of these figures, which can not be directly compared, the head mechanic is convinced that diesel operation is cheaper and is recommending a complete change-over from gasoline to diesel power. Apparently, the type



An electrical section is also included in Towmotor's New York shop. Electrical equipment is rebuilt and tested at this point.

If fast service is to be given, a well-stocked parts department is a must. Only a small section of Towmotor's New York parts department is shown.

In the engine rebuilding section of the shop, trained mechanics carefully rebuild units from the block up.

of operation produces a much wider than normal differential between diesel and gasoline fuel consumption rates.

Savings resulting from the lower cost of diesel fuel will vary all over the lot depending on the geographical location, grade of fuel, method of handling and quantities used. One stevedoring firm, operating both gasoline and diesel-powered units, is reportedly paying 11.7 cents per gal for 50 cetane diesel fuel as compared to 16.4 cents per gal for gasoline. This firm is now planning to convert their gasoline-powered units to diesel.

Peculiar to stevedoring operations are savings which accrue from lowering out-of-service time. Much of this lost time can be attributed to the hazard of using gasoline as a fuel as all refueling and servicing of gasoline-powered units must take place away from the docks. Still more time is lost in running these units to and from a storage area, which must also be away from the docks, at the start and end of an operating period.

With the use of diesel-powered units, this time may be shortened considerably. Insurance underwriters and port authorities have permitted the refueling, servicing, and storage of diesel units on the docks.

Out-of-service time due to breakdowns is also shortened by the diesel's reliability. The diesel has proved its ability to operate for long periods with less time out for repairs than a gasoline engine.

Insurance may also add to the savings of diesel operation. In many cases where a change was made from gasoline to diesel a reduction in insurance rates has followed. The reasons for this are apparent, the main one being that potential fire hazards due to the volatility and low flashpoint of gasoline are eliminated with the use of diesel fuel. This brings us to other safety features of the diesel.

Two of the main problems encountered with operation of gasoline-powered units have been toxic exhaust gases and danger of explosions in dust-laden or other hazardous areas. Extensive study by the U. S. Bureau of Mines has proved that when certain conditions are met, diesels can be used even in underground mining operations which are considered to be hazardous areas in most cases.

Unlike the gasoline or electrically-powered fork lift units, the diesel can be adapted for operation in poorly ventilated or potentially explosive atmospheres such as in the holds of ships with a minimum of modifications. Since the diesel requires no electrical system for operation, there will be no danger of sparks from this source.

Where the unit is equipped with an electrical starting system, the battery need only be removed and quick-disconnect couplings used as the starting medium outside the hazardous area. Air or hydraulic accumulator-type starters can also be used as an optional arrangement.

It might be well to point out that a diesel in its poorest state of adjustment will produce less carbon monoxide than a gasoline engine in best state of adjustment.

Stevedoring operations are hard on equipment. A stack of empty pallets is perhaps the lightest load handled in the course of a day's operation.

One draft of coffee weighs a little over a ton. This is 2-ton machine powered by a 4-cyl Continental diesel.

A second unit in the same loft picks up a draft from the scales. Stevedores like the diesels units because of their greater power.

This should give some indication of the safety with which a diesel fork lift can be operated in a poorly ventilated ship's hold.

Equipped with a water-cooled exhaust manifold engineered for the unit, diesel exhaust temperatures can be held within the safe limits required for operation in dust-laden holds or other hazardous areas.

Maintenance

Many firms do not have sufficient numbers of fork lift units to warrant a full-time mechanic. For this reason, Towmotor maintains well-equipped shops in New York and other cities along with adequate supplies of parts. In addition to these, two preventive maintenance trucks are kept constantly on the move servicing some 135 gasoline and diesel-powered Towmotors in and around New York City.

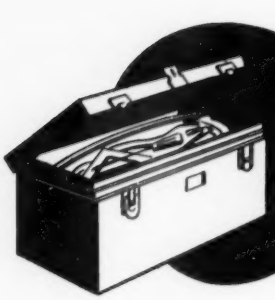
Highlight of this well-planned preventive maintenance system is a service agreement tailored to meet the needs of individual operating requirements. Under this system, a PM record is kept on each unit by the distributor. When a unit is due for periodical maintenance, a rolling shop appears at the job site without prior notice by the owner.

Factory-trained mechanics inspect the equipment from top to bottom making all necessary adjustments which can be made in the field. At the end of each inspection a report is forwarded to the operator, indicating the condition of his equipment. With an arrangement of this sort, an operator with only one unit can have a preventive maintenance system similar to that used in large fleets at a fraction of what it would cost to hire a mechanic or tool up to do his own work.

Besides the two preventive maintenance trucks, two service trucks stand by to rush mechanics and parts out to a job site should a unit break down. Fast service of this sort further protects operators by eliminating many hours of costly down-time.

Summarizing

Diesel-powered fork lift trucks and industrial towing tractors can and are contributing greatly toward lowering the cost of materials handling on the docks. Reduced operating expenses, greater availability for production along with greater safety to installations as well as personnel, are some of the more apparent advantages. This is only one application of these versatile machines in the broad field of materials handling.



Straight from the Tool Box

This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.

Importance of Clean Scavenging Air

HAROLD HOWLETT, SCRANTON, PENNSYLVANIA—I don't know whether you call this a shop hint or not, but I am sending it along anyway. It is some of the experience that I have picked up concerning engine air while working around a lot of different engines.

One of the first things to check is whether the engine is getting enough air. I have had fellows complain to me about smoky exhausts and want me to rip out and fix the injection system. Sometimes it was a bad nozzle or a pump, but just as often it was a very dirty air filter or, with 2-cycle engines, carbonized ports. When these were cleaned up and the engine got enough air for good combustion, the exhaust cleared up.

I have even seen cases where badly made gaskets interfered with the air flow. The big point is that the effect of these things on engine operation should be realized and checked before jumping into a more expensive job.

The second point is about getting clean air. On one job a tractor owner-operator called me in, lifted the cap on the oil filler pipe, and asked me if the blue smoke coming out meant anything. He did not think that it was blowby because he had had an overhaul with new liners, pistons and rings a short time before. The whole job had to be done again and the parts were a mess.

The reason for all this was a badly cracked intake pipe, and all the grit and dust around where he was working had been sucked into the engine. This was a bad case, but even a pinhole can do it over a little time. There is no reason for this as I have found a lot of different tapes that can be used for sealing small holes to make sure that *all* the air goes through the filter.

It could be that I am a bug on this subject, but I have seen so much neglect — some of it criminal — of these things and have seen so many troubles that result, that I see red everytime that it comes up. It is never the operator's fault; it is always due to a lousy engine or an air filter that is no good, or anything else that is handy to blame. And most of them don't even clean the air filter. I am for bigger and better air filters and then good servicing of them.

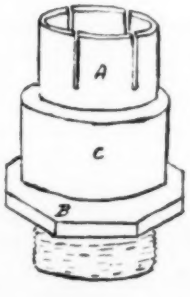
How true, how true. You could compile an authoritative bibliography, weighing several tons, that would prove conclusively that dirt is one of the worst enemies of an engine. The point concerning keeping the induction system tight beyond the air filter is well taken. It is surprising how much dirt can enter through a very small hole, particularly in such services as earthmoving. This will negate even good filter servicing. About the "bigger" air filters, we would like to amend it to "adequate." It is possible to get them too big, particularly the viscous impingement type. Airflow is too low and the particles have time to find their way through the interstices—Editor

Hand Vise for Round Parts

W. E. WARNER, WOODFORD GREEN, ENGLAND—Holding small round parts is frequently a problem around the shop. Where a great enough number of a certain part is handled to make a special tool desirable, a collet-type hand vise is easy to make.

A piece of steel pipe (A), with a diameter to suit the work on hand, is cut to a convenient length, say six inches. One end is threaded, and four longitudinal hacksaw cuts are made in the other end so that it can be belled out slightly to receive the work.

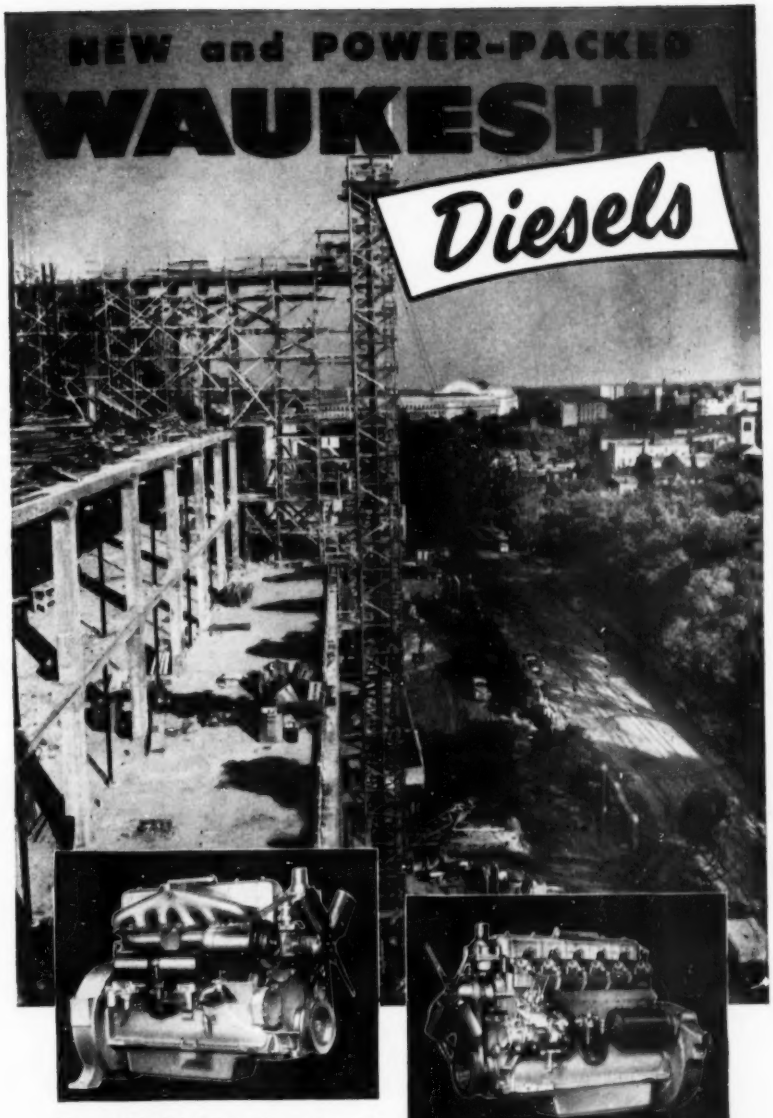
A nut (B) with an extension (C) welded to it is threaded on the pipe. The ID of the extension is about the same as the pipe OD. As the nut assembly is screwed up, it will collapse the upper end of the pipe, gripping the work. Screwing it downward, of course, frees the work for removal from the hand vise. Depending upon material and tooling availability, the idea can be extended to construct soft-jaw chucks for small pistons, etc.



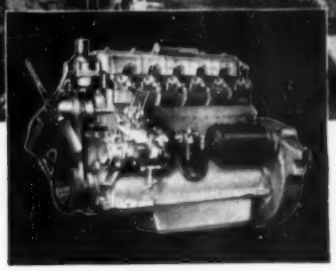
WAUKESHA

Diesels

13 hp
to
570 hp



The 195-DLC Medium Speed Diesel, manifold side, showing intake and up-exhaust manifolding; waste-packed lubricating oil filters; 12-volt pivot-mounted belt-driven generator; fuel supply pump; water pump by-pass, and foot-type flywheel housing.



195-DLCA High Speed Diesel, injection side, with pump mounted governor and fuel supply pump, fuel filter, water pump, single orifice pintle-type nozzles, drawn steel injection tubing of uniform length, 12-volt starting motor, vibration dampner, arm-type flywheel housing.

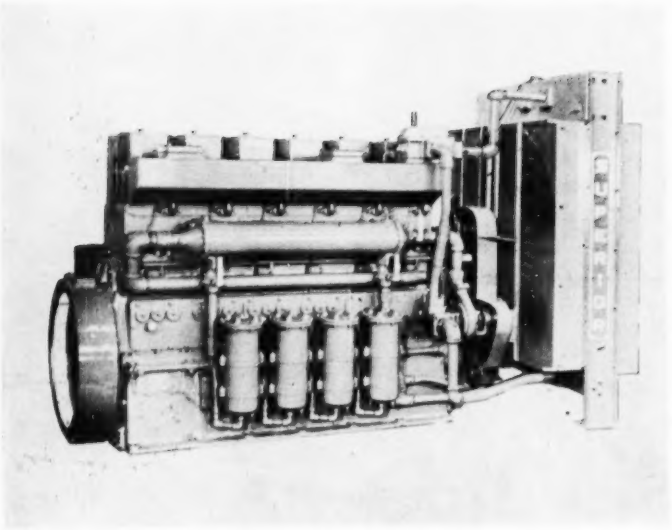
GET BULLETIN 1624

A high-output high-speed Diesel, with counterbalanced crankshaft, 195-DLCA has a 98 hp max. @ 2800 rpm. The medium speed, with standard crankshaft, 195-DLC has a 96 hp max. @ 2400 rpm for momentary overload, 86 hp @ 2400 intermittent and 67 hp @ 2000 for continuous duty. Both models have aluminum pistons, six cylinders, 4-in. x 4-in., 302 cu. in. displ.

208

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
New York • Tulsa • Los Angeles

PRODUCT



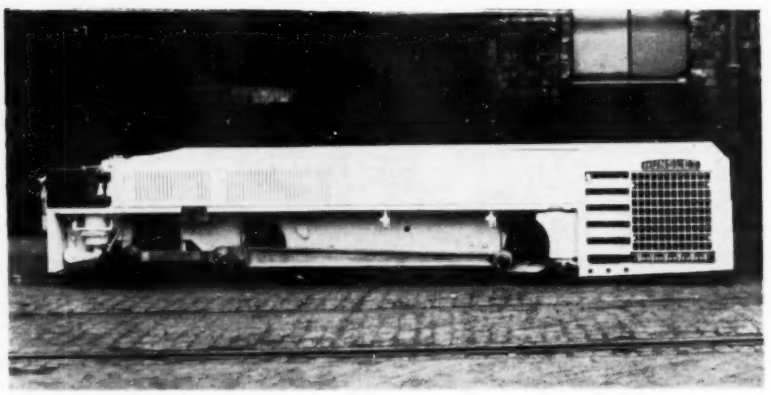
Spark-Ignition Gas Engines

Developed primarily for drilling service, this Superior Model G-825 was exhibited for the first time at the recent International Petroleum Exposition. The unit is available in 6- and 8-cyl executions with continuous ratings of 450 and 600 hp, respectively, at 900 rpm. Bore and stroke are 10 in by 10½ in.

One feature stressed is parts interchangeability. Many of the parts are interchangeable with those used on the Superior Model PDT diesel drilling engine. Another feature is the interchangeability of both type engines on the same drilling rig skids. Although developed primarily for drilling service, the engine is suitable for other types of service. Further information is available from The National Supply Co., Springfield 99, Ohio.

Mine Locomotive

Built by the Hunslet Engine Co., Ltd., Leeds, England, this unit was designed specifically for U. S. coal mines. Designs meet the requirements of the U. S. Bureau of Mines and answer all the questions of the Mine Workers' Union, according to Hunslet. Power for the 170-hp unit is supplied by a Cummins Model NHHB1-600 "flat" engine. Capacity is 700 tons at 5½ mph in low gear.



Mack's "B" Series

A line of trucks and tractors known as the B Series has recently been introduced by Mack Trucks, Inc. The line includes both 4- and 6-wheel types covering a range from 17,000 lb GVW through 70,000 lb GVW. A variety of Mack engines are offered with the line, with the two Mack diesels covering the 138 to 170 hp class.

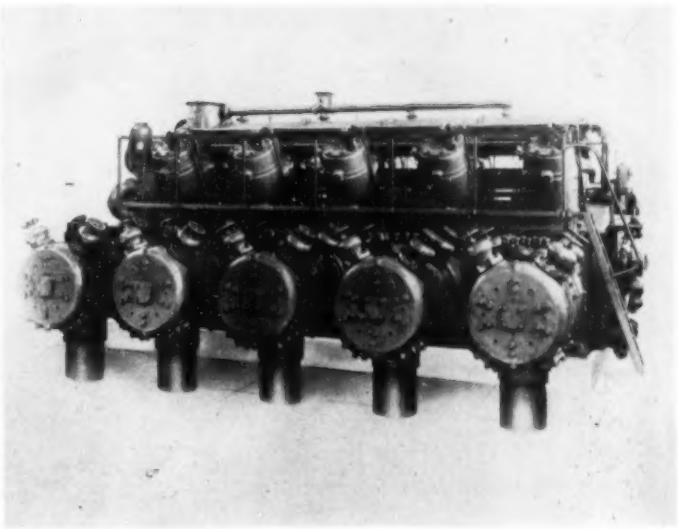
Greater payload capacity is provided by reduction in unit weight without sacrificing strength. Complete information and specifications are available from Mack Trucks, Inc., 350 Fifth Ave., New York 1, N. Y., or from any local Mack branch or distributor.

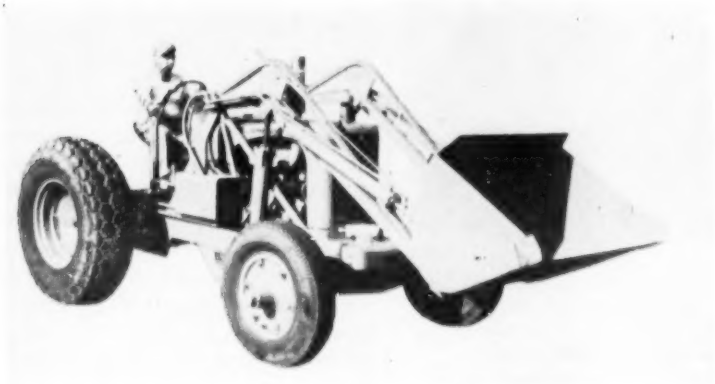
PREVIEW

Engine-Compressor

An engine development, designed to save industry 10 per cent in fuel costs, has been announced by the Cooper-Bessemer Corp. In addition to cutting fuel consumption to as low as 7500 Btu per hp hr, 1/3 more hp per cu ft of space is claimed.

Identified as the GMVA, the development evolved from the GMV compressor. C-B's Model GMVA engine is available in 4-, 6-, 8-, and 10-cyl units. Rating for the engines is 135 hp per cyl, providing a range of from 540 to 1350 hp. Ralph L. Boyer, vice president and chief engineer of C-B, states: "Its fuel economy and increased output of power offer many immediate advantages to compressor operators". Engine specifications are available from Cooper-Bessemer, Mount Vernon, Ohio.





Shoveloader

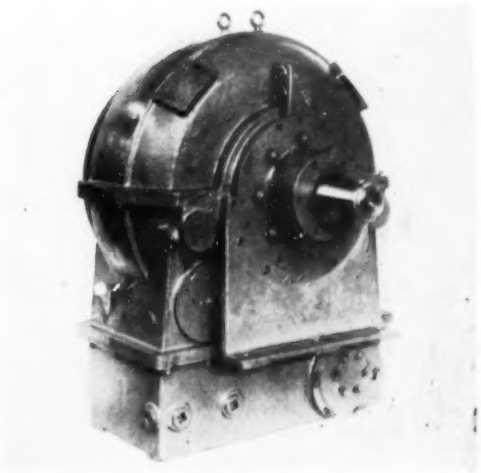
The combination of economic diesel power and front end loading up to 5000-lb capacity is offered in the Baker-Lull Shoveloader. The loader is mounted on a Sheppard industrial wheel-type tractor.

Seven materials handling tools are available for use with the Shoveloader. Descriptive literature is available from Baker-Lull, 314 W. 90th St., Minneapolis 20, Minn.

Torque Converters

Development of two hydraulic torque converters for use with high torque medium-speed engines was recently announced by The National Supply Co. of Pittsburgh, Pa. The hydraulic torque converters, which were designed by National's engineers, cover a power range of from 325 to more than 1000 hp.

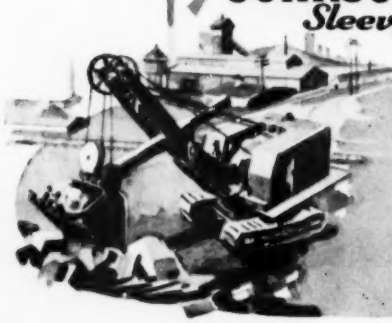
Performance characteristics and heavy-duty design were provided to meet the service condition of many industrial applications where inherent smoothness of a hydraulic drive is advantageous in handling continuously fluctuating loads or to start and accelerate heavy loads repeatedly. Typical of such service conditions are power shovel, hoist, switching locomotive, well drilling, and other industrial applications. In this type of service, engines can operate at peak performance with no lugging since the converter automatically varies the output speed and torque multiplication instantly as the load changes.



THIS NEW JOHNSON DEVELOPMENT in diesel bearings is attracting a lot of interest in the industry. Diesel engineers are looking for bearings for high load engine performance. Are you? The properties of the aluminum alloys bonded to steel seem best suited to high speeds and high loads. Johnson Aluminum-on-Steel Sleeve Bearings may be used for loads up to 4000 P.S.I., yet have excellent corrosion resistance and resistance to fatigue, good conformability and imbeddability, good resistance to shaft wear, and adequate seizure resistance. Although comparatively new, there are more than a half million of these Johnson Aluminum-on-Steel Bearings in diesel use today. Write for complete information.

JOHNSON BRONZE COMPANY
470 South Mill Street, New Castle, Pa.

JOHNSON JB BEARINGS
Sleeve-Type



JOHNSON BRONZE PRODUCES ALL TYPES OF SLEEVE BEARINGS: BRONZE-ON-STEEL, copper lead • STEEL BACK, Babbitt Lined BRONZE BACK, babbitt lined • CAST BRONZE, plain or graphited SHEET BRONZE, plain or graphited CAST ALUMINUM ALLOY LEDALOYL powder metallurgy

Liquid Level Control

A new type of electronic liquid level control utilizing an all cold cathode tube design and eliminating the possibility of hot tube failure has been announced by Haledy Electronics Co., 57 William St., New York 5, N. Y. Contact with liquids is made by stainless steel rods and no moving parts inside tank are required. Accuracy is claimed to be completely independent of pressure and temperature.

The control utilizes a triode tube, having high amplification factor, which does not require filament or plate transformer or circuitry and therefore uses no warmup or standby current. When fluid comes into contact with an electrode, with a minute current, suspended at a pre-determined level, current is amplified by the tube and is then utilized to operate a relay to control application devices. Current across the electrode is less than two micro amperes and thus the system is claimed safe for wide ranges of liquids. Electrode corrosion is said to be negligible.

Sequence Valve

An improved valve permitting single control of multi-operations has been announced by Airmatic Valve, Inc., 7317 Associate Ave., Cleveland 9, Ohio. Its use is said to increase production with less fatigue by enabling operation of two or more cylinders in their correct sequence without manual handling. High sensitivity allows positive operation at pressures from 20 to 200 psi—air, oil, or water.

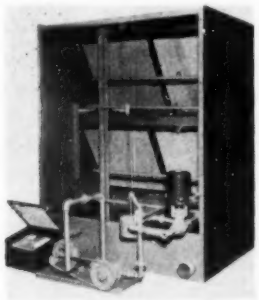
Inner-Fin Oil Coolers

The Heat-X-Changer Co., Brewster, N. Y., is introducing a new line of inner-fin oil coolers using a longitudinal inner-fin to make possible a more compact unit than previously.

Oil flows through the inner fins which provide surface for cooling with minimum pressure drop. Models are suitable for oil side pressures up to 250 psi and temperatures up to 300°F. Water side is suitable for pressures up to 150 psi. The inner-finned element is copper and removable for cleaning and replacement. Synthetic rubber O rings are used to provide positive seals.

Improved Self-Washing Filter

New features incorporated in the self-washing filter of the Farr Co., P. O. Box 10187 Airport Station, Los Angeles 45, Cal., include the addition of test buttons to enable operation of the washing and re-oiling mechanism without disturbing the automatic cleaning cycle, and the introduction of a unit to drain all water lines automatically to protect against freezing. Spring-actuated, the new drain unit requires 20- to 25-lb operating pressure. Test buttons have been installed so that the cleaning and oiling mechanisms can be tested and operated at will without disturbing the automatic timing cycle.

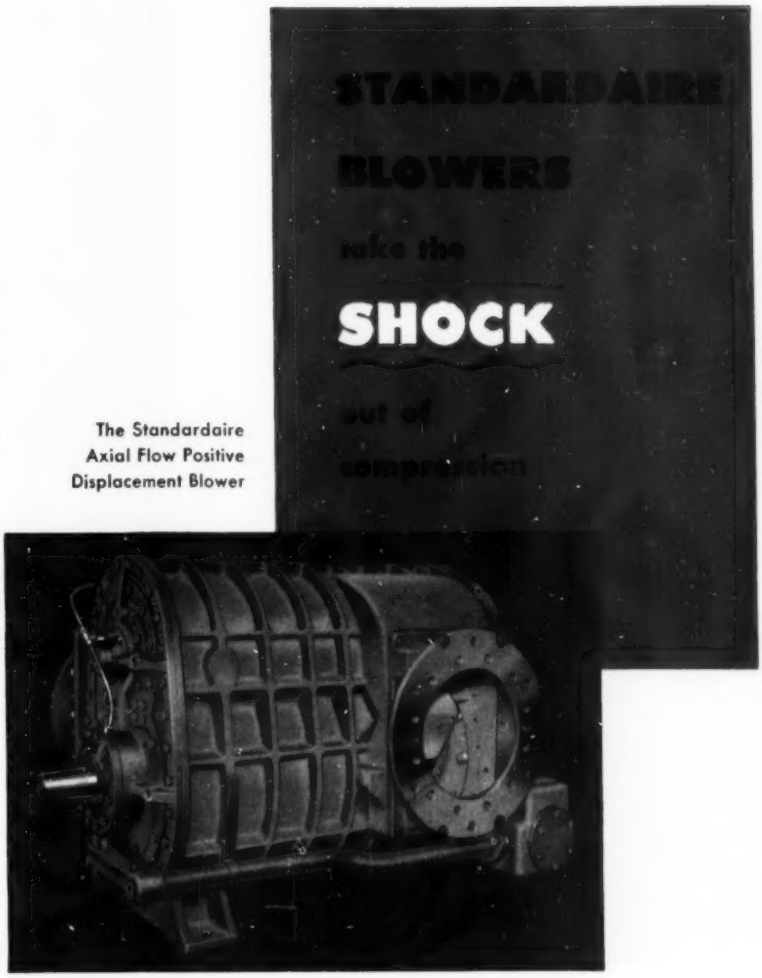


The self-washing filters are equipped with 20-in by 20-in by 4-in units installed at a 30-deg angle toward the air flow. A series of automatically controlled water and oil jets on the entering air side periodically wash and re-oil the filter units. Filters are available to handle any cfm requirement.

Liquid-Tight Conduit Fitting

A new fitting for liquid-tight flexible conduit mates has been announced by Thomas & Betts Co., Elizabeth, N. J. The fitting is claimed ideal for wiring exposed to corrosive liquids. It is made in straight, 90-deg and 45-deg elbow design and accomodates conduit from $\frac{3}{8}$- to 2-in trade size.

Only one wrench size is said to be needed for the gland and body. A conical shaped ground wedges inside the conduit in a tight fit. The gland is tightened around the conduit and the joint is completed. Because the ground's wedge-type action does not depend on the particular conduit spiral, the fitting is enabled to mate with any conduit spiral and does not have to be taken apart for installation.



The Standardaire Axial Flow Positive Displacement Blower

Standardaire Axial Flow Positive Displacement Blowers operate on a principle of compression unlike any other blowers. Their symmetrically generated rotors act as an air screw, drawing in and discharging air smoothly from the pockets which form between them.

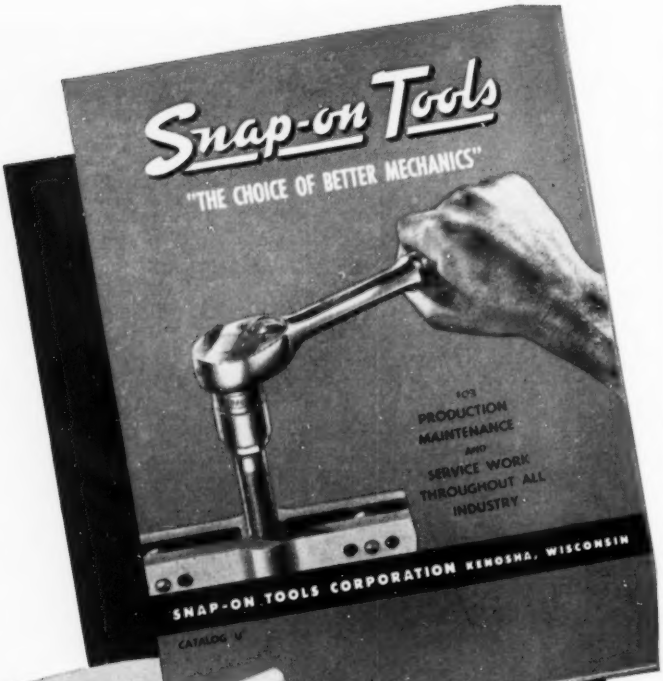
Compression is gradual, completely internal and free from shock. Internal pressure is raised to equal discharge pressure before the pocket registers with the discharge port, eliminating the slap back and loading of internal parts common to many types of blowers.

Standardaire Blowers move more air, with less wear, less maintenance and power cost than any blowers of equal weight, size or comparable design.

For further information, write:

CORPORATION

BLOWER-STOKER DIVISION
370 Lexington Avenue, New York 17, New York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New Lubrication Fitting

A lubricating fitting, featuring three checks against loss of lubricant, line fluids, or gas, and especially designed for use on lubricated plug valves where extreme back pressures are encountered, has been announced by the Alemite Div. of Stewart-Warner Corp., 1826 Diversey Pkwy., Chicago 14, Ill.

Fitting features two ball checks augmenting standard check valve at top of fitting. It also replaces the lubricant screw so that the lubricant may be injected into the valve directly from a hand gun or bucket pump.

5-Range Hand Tachometers

Herman H. Sticht Co., Inc., 27 Park Pl., New York 7, N. Y., announces a new hand tachometer of the Universal class with five ranges. Known as Type "UC", it features an improved slip coupling overspeed device to prevent damage to the mechanism due to accidental overspeeding in the wrong range.

The tachometer is non-magnetic and operates on the principle of a centrifugal governor. All parts are light and in balance and pointer instantly responds to change in speed. The instrument is direct reading and is independent of direction of rotation so that it can be used in any position. It comes in a carrying case with accessories.

Square Gauge Blocks

Fonda Gage Sales Corp., 38 Broad St., Port Chester, N. Y., is now offering a complete line of square gauge blocks. With inclusion of the new square blocks, the company is now able to supply both square and rectangular types in three materials—steel, carbide and chrome carbide.

Remote Signal Adapter Unit

A new adapter unit which permits remotely located visual trouble signals to operate as part of a common plant wide audio-visual annunciator system has been announced by Panalarm Products, Inc., 6312 No. Broadway, Chicago 40, Ill.

For the remote visual signals, either individual backlighted illuminated nameplate units or bullseye lamps are furnished to be used for scattered locations on panelboards or operating locations in the plant. Bullseye lamps may also be used with separate on-off lights to form a three-light control station. All signals connect to a common horn or bell which must b acknowledged by operator when an off-normal condition develops.

Moving parts and contacts are enclosed in hermetically sealed plug-in units which are said to be corrosion-proof and suitable for Class I, Division 2 locations. Additional signals may be added to the system by inserting plug-in units into chassis receptacles. The cabinet is pre-wired for all standard audio-visual sequences and may be interchanged in the field by simple terminal connections. The cabinets are furnished for any desired number of signals and operate from any type of remote contact device.

Lubrication of Valves

Two newly designed lubricant tubes, a flat-top gun tube and a long-spouted bulk tube are offered by Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa., for lubrication of Nordstrom valves. More effective and economical lubrication are claimed.

With the flat-top tube, a lube-gun is loaded "in a matter of seconds" by cutting off the tube top and turning a key which squeezes contents directly into barrel. With the long-spouted tube, a valve lube chamber "can be filled easier because the spout gets the lube further down into the valve shank than previously." One tube is said to fit all Nordstrom valve sizes.

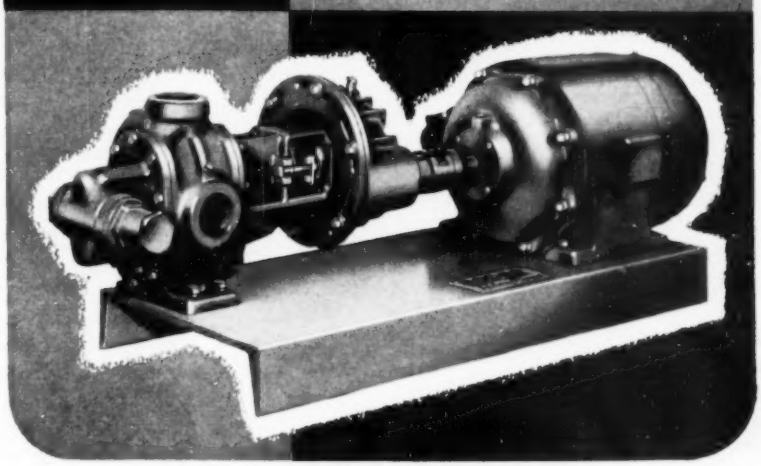
Gun lubricant tubes are available in packages of six; the bulk tubes singly and in packages of four. Eight types of lubricants are available in the new tubes.

QUALIFIES FOR THE JOB ON MANY COUNTS

ROPER

SERIES 3600

PUMP



If you have a job open for a pump, then by all means consider the Roper Series 3600 as the heart of your fuel transfer system. Designed to handle thin or thick liquids quickly and safely, these pumps offer you the many advantages of the rotary gear principle, plus a most important benefit — Roper *dependability.* There is a size for your needs, as models are available from 40 to 300 G.P.M. sizes — pressures to 60 P.S.I.

Check AND COMPARE THESE FEATURES

- **Compact** . . . requires minimum of installation space.
- **Indoors or Outdoors** . . . no pump house needed.
- **Gear Reduction** . . . totally enclosed and running in oil. Three gear ratios available.
- **Anti-Friction** bearings throughout gear reduction.
- **Steel Bed Plate** provides rigid foundation for pump and motor.
- **Operation** . . . unusually smooth and quiet; pump operates in either direction.
- **Suction Lift** . . . up to 15 feet at 60 P.S.I.
- **Helical Gears** . . . run in axial hydraulic balance. Pump fitted with 4 high-lead bronze bearings; split-type gland.

See Your Roper Distributor or Write for Catalog

GEO. D. ROPER CORPORATION
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Rockford, Illinois

ROPER Rotary Pumps

Liquid Level Tank Gauges

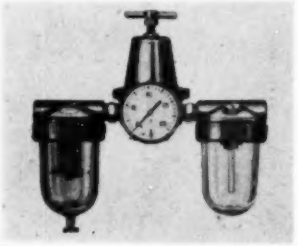
Nathan Mfg. Co., 416 E. 106 St., New York 29, N. Y., is now offering its Glo-Rod liquid level and tank filling gauges, successful on diesel fuel tanks, for use in other fields. The gauges are useful for colorless liquids and daylight sight readings are said to give accurate checks with no light loss through reflection.

Normal illumination transmits the light upward through a plastic rod causing the liquid to appear as dots below the surface and as dashes above. The gauge can also be illuminated by a flashlight when applied to darkened areas, or an electric unit is furnished when permanent lighting is required.

No separate mounting brackets are required when gauges are attached directly to tank walls. Where this is not possible, the company has an automatic cut-off valve to eliminate loss of fluid caused by breaks in piping between tank and gauge. Where needed for use in restricted space, gauges are available with the reading face offset 30 or 90 deg available for either right or left hand application.

Air Filter-Regulator-Lubricator

A new type of filter-regulator-lubricator unit for air tools, is being produced by Arrow Tools, Inc., 1900 S. Kostner Ave., Chicago 23, Ill. One feature is the porous bronze element which is said to retain a greater amount of sediment on its outer surface without serious loss of pressure.



When air or filtrate enters unit, centrifugal action throws moisture and heavier solids against the bowl and downward below the baffle where it is deposited. Air or filtrate then goes through bronze element which allows only clean air or filtrate to pass. Amount of deposit is observed through transparent bowl and removed through drain cock at bottom of bowl. Element can be removed and cleaned with a blast of air from the inside to dislodge sediment on outer surface.

The lubricator has been designed to deliver a vaporized mist of oil into the air stream to the precision working parts of equipment. A porous bronze feeder wick forces lubricant to enter air stream in a fine mist. Wick setting is readily observed through transparent bowl, and oil delivery can be regulated by varying elevation of the wick in the air stream. Various combinations may be used where complete unit is not required.

New Speed Control Valve

A speed control valve which can be used wherever it is necessary to control the flow of air, has been announced by Ross Operating Co., 120 E. Golden Gate, Detroit 3, Mich. The valve, which provides split-second timing of piston movement by positive control of air flow, can be mounted in any position between operating valve and one or both ends of a cylinder.

Adjustment is said to be easy and extra turning allowance is provided wherever required. The orifice con-

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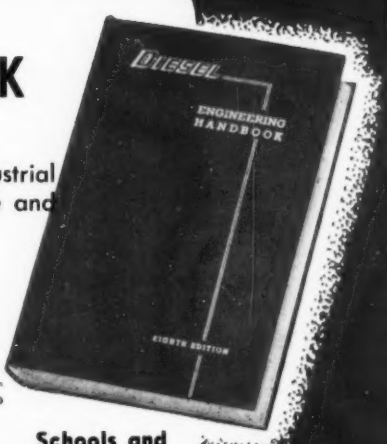


Schools and Colleges Investigate this Excellent Text Book

DIESEL PUBLICATIONS, Inc.
192 Lexington Avenue, New York 16, N. Y.

Practical Book for Practical Men

trolling flow can be adjusted with the stem from zero to wide open, with absolute accuracy claimed. Poppet is only moving part and valve can be disassembled without breaking line connection.

Redesigned Leak Detector

General Electric, Schenectady 5, N. Y., announces redesign of its halogen-sensitive leak detector to permit easier detection of leaks in closed systems. The portable instrument is claimed to detect a leak so small that only 1/100 oz of gas will pass through the opening in a year.

In the redesigned equipment, a loudspeaker has been added for audible indication of leaks. Also featured is an automatic balancing circuit to compensate for changes in background air contamination. An internal voltage stabilizer is incorporated in place of an external stabilizer. It retains the earphone plug and instrument indication of leaks so that indication can be simultaneously obtained by means of the dial, earphone attachment, built-in loudspeaker.

New Clutch Development

A new development by the Formsprag Co., 23601 Hoover Rd., Van Dyke, Mich., is said to make possible operation of over-running clutches at speeds exceeding 300 rpm. A centrifugal throwout sprag assembly is claimed to eliminate rubbing between the sprags and the inner race.

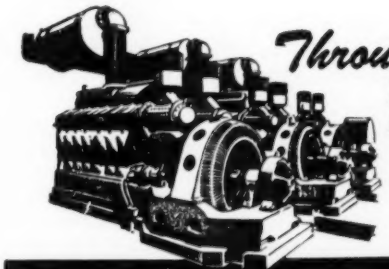
The new feature is available in the company's all-purpose ball bearing clutch, a standard model with eight possible variations. Construction of the clutches consists of four basic parts: outer housing, inner race, sprags, and energizing springs.

To Cut Rail Roadbed Noise

The Dayton Rubber Co., 10 Rubber St., Dayton 1, Ohio, recently announced development of a rubber-cushioned tie plate which it said would cut down "clickety-clack" roadbed noises. The rubber insert, made of a combination of synthetic and natural compounds, cushions the shock load between rail and tie, increasing the life of both, the company said.

There is a competent Aerofin heat-transfer engineer near you—qualified by intensive training and long experience to find the *right* answer to your own particular heat-exchange problem—and backed by the research and production facilities of the pioneers in light-weight extended surface.

Ask the Aerofin Man.



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Aerofin units do the job Better, Faster, Cheaper

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Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

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A complete line of instruments in all types, sizes and ranges required for switchboard and panel needs... including d-c, a-c power frequencies and radio frequency, rectifier types and D.B. meters.

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For complex, or just routine measurement jobs, these and other specialized WESTON Instruments save time and assure dependable measurements. For information on the complete line, see your local Weston representative, or write . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

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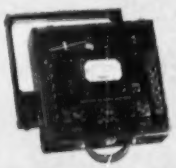
Ultra-Sensitive Instruments

Portable d-c and a-c thermo instruments for precision measurement of potentials and minute currents in electronics or laboratory research.

Model 697 Volt-Ohm-Milliammeter

One of a line of pocket-size meters, Model 697 combines a selection of a-c and d-c current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.



Industrial Circuit Tester—Model 785

A multi-range, multi-purpose, ultra-sensitive analyzer, for laboratory and industrial checking of electrical and electronic circuits. Has 28 practical scale ranges; measures d-c and a-c voltage, d-c and a-c current, and resistance. Accessories available to extend ranges. Compact and portable; furnished in either oak or steel case.

Model 901
Portable Test Instruments

Available in d-c, Model 901 and a-c, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

Book Reviews

The High-Speed Internal Combustion Engine (4th rev. ed.)—by Sir Harry R. Ricardo, Blackie & Son, Ltd., London, U. S. distributor: Autobooks, 2708 Magnolia Blvd., Burbank, Cal., 420 pages, $11.

First edition of this book was in 1923. Since then, because of new developments in the design of high-speed internal combustion engines, the author has undertaken a complete rewriting of the book. As a leading authority in the field, Sir Harry Ricardo writes from direct experience, with resultant skill in his analysis of the many complex problems arising.

Rather than attempting to cover a very wide range of the subject, he concentrates on the lessons derived from his 35 years of research and development work in an effort to bridge the gap between the scientist and the practical engineer.

The book is roughly divided into three sections, the first dealing with general principles indicating trends and tendencies, the next with structure, and concluding with a discussion on the design and development of special engines for research.

A listing of several chapter titles is sufficient to give an indication of the scope of the volume: Combustion-Chamber Design, Cold-Starting of Compression-Ignition Engines, Mechanical Efficiency, Supercharging, The Two-Cycle Engine, Pistons and Piston Cooling, Cylinder Wear, Sleeve-Valve Engines. Particular stress is given to the subject of mechanical efficiency which the author feels has been neglected.

Trane Air Conditioning Manual (2nd rev. ed.)—The Trane Co., La Crosse, Wis., 330 pages, $5.

The general purpose of this book, the present edition of which marks the seventeenth printing and second major revision since 1938, has been to assemble and present the factual material of air conditioning so that a well organized grasp of the subject and a clear picture of the relationships existing between the complex principles involved in the design of an air conditioning system could be obtained.

Primarily concerned with the appli-

cation of the fundamental facts of engineering to the design of air conditioning systems, the data contained in these pages can be applied to various diesel problems as well, involving air characteristics of flow, cooling, etc.

Beginning with a simplified presentation of basic physical laws governing heat and cold, the new manual applies the laws to practical problems. A new fan and duct chapter embodies latest engineering thinking. Text is illustrated with drawings, photographs, charts and graphs. A reference section contains standard tables on air, refrigerants, and pipe capacities.

New Literature

Automatic Utility Supervision

New applications of electronic time and program controls are outlined in a folder offered by International Business Machines Corp., 590 Madison Ave., New York 22, N. Y. These controls, used with proper intermediate electrical devices, are said to provide automatic means of programming the starting and stopping of many mechanical functions without need for special wiring. Regular AC lighting wires are used.

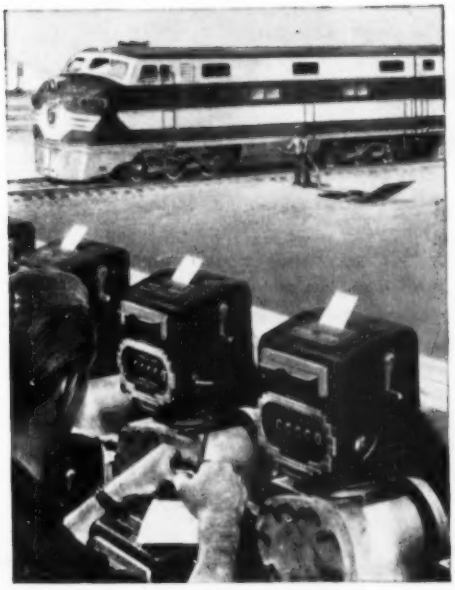
Applications for which the controls can be used are outlined and include operation of relays, solenoids, etc., to automatically start and stop operations. Programs may be set up for varied daily schedules as well as for inoperative periods such as weekends.

ASHVE Issues 1953 Guide

The 1953 edition of *The Heating, Ventilating and Air Conditioning Guide,* published annually by The American Society of Heating and Ventilating Engineers, 62 Worth St., New York, N. Y., has just been issued. This 31st edition has a total of 1560 pages and features many important changes and additions.

Oil Jobber Accounting Manual

An accounting manual for oil jobbers and distributors—"something that has been needed for a long time by smaller firms which do not employ professional accountants"—was approved for publication by the American Petroleum Institute at its mid-year meeting. The manual will be made



CUT COSTS— STOP LOSSES FUELING DIESEL LOCOMOTIVES

With the Rockwell Remote Registration System

Remote registration of fuel loaded into Diesels can offer you some startling advantages and savings. First you put the sole control over all metered outlets in the hands of one supervisor. He operates from a control room overlooking the entire fueling area. No fuel can be drawn until he inserts a ticket in the proper printing register and activates the matching electric circuit. At the completion of the fill the unalterable ticket shows the exact gallonage loaded.

In addition to providing positive proof of actual deliveries, carbons of these remotely printed tickets can be used for inventory control, to verify tax payments and to form the basis for a completely mechanized accounting procedure.

This ticket is sealed into and printed by the remote register. It guards against human errors, doubts and losses—provides permanent indisputable records for inventory control, cost and tax accounting.

HOW THIS BETTER SYSTEM WORKS

The row of office printing registers (shown in main illustration above) is electrically synchronized to standard registers on Rockwell Rotocycle meters in the fueling pits outside. Each office register is permanently interlocked to one meter register and all gallonage dispensed by that meter is accurately recorded, then printed under the direct, watchful control of the dispatcher. The entire system bears the Underwriters' Laboratory seal of approval.

WRITE FOR BULLETIN OG-324

ROCKWELL MANUFACTURING COMPANY
401 N. Lexington Avenue · Pittsburgh 8, Pa.

available to industry at cost, and will go to press immediately.

Covered are the following: sample balance sheet and schedule of balance sheet accounts; sample income statement and schedule of sales, costs and operating expense accounts; sample closing entries; sample forms and books of record and suggested methods for recording sales, purchases, payrolls, etc.; a method for analyzing accounts receivable and for controlling costs; how to analyze financial statements to point out weak spots and remedies.

Fleet Maintenance Manual

Wix Accessories Corp., Gastonia, N. C., is offering a maintenance manual incorporating the better features of fleet maintenance records now in use. Consisting of 8½- by 11-in ledger type loose-leaf pages in a durable cover, the manual includes a fleet control survey sheet, maintenance guide and record, check lists, records of work performed, reference to mechanical condition of each fleet vehicle, a guide for information about suppliers of parts and services, and other useful aids.

How to buy more diesel for your money
Get the one that has the Lanova Combustion System
You'll get more "payload" power at less cost with a Lanova-type diesel. That's because the Lanova Combustion System—developed especially for modern high speed engines—is designed to get more work out of every ounce of fuel used. It does this by promoting peak combustion conditions in the cylinder and by timing and controlling the application of cylinder pressures to take full advantage of the piston's working thrust.
Chances are—the engine you're now considering has the Lanova Combustion System, because its outstanding advantages have led many leading diesel manufacturers to adopt this design. But, before you make any decision, it will pay you to . . .
Send for the Lanova handbook—This informative 58-page handbook has full details on the important role combustion plays in efficient low-cost Diesel performance. Write for it today.
Lanova
LANOVA CORPORATION
38-19 30th Street, Long Island City 1, N. Y.
One of America's foremost names in diesel research and development

Blast Cleaning Hose Machines

Pangborn Corp., Hagerstown, Md., has issued a new bulletin describing its blast cleaning hose machines for hand-operated cleaning jobs. Two fundamental methods of applying abrasive, direct pressure and suction, are described as well as application of both wet and soft abrasives.

Tables show relationship between orifice area and circumference in nozzle sizes, and air flow with required hp to develop air jets of varying diameters. Selection of proper types of machines are discussed. A useful table graphically shows how to match nozzle size to size of abrasive used. Specifications are given for various types of abrasives available along with recommendations for their use.

MoS_2 As A Lubricant

"Properties and Uses of Pure Molybdenum Disulphide as a Lubricant", a paper presented before the American Society of Lubrication Engineers, is now available from The Alpha Corp., Greenwich, Conn.

The paper covers an analysis of the compound and its qualities as a lubricant: its chemical stability, electrical properties, purity, anti-corrosion properties, thermal stability, coefficient of friction, and the various methods of application. It is complete with graphic illustrations.

Diesel Engine Bulletin

Bulletin L-6841 has been issued by the Fageol Products Div. of Twin Coach Co., Kent, Ohio, on Fageol-Leyland diesel engines for stationary, automotive and marine applications. Illustrated with photographs, cutaway and section views, horsepower and torque curves, the 6-page bulletin covers horizontal and vertical models of both the 600-and 680-cu in engines.

New Metal Hose Data Book

Edited to satisfy both the engineer's and purchasing agent's wants for information, Universal Metal Hose Co., 2133 S. Kedzie Ave., Chicago 23, Ill., is offering a compact data book including information on application, temperature ranges, dimensions, couplings, assemblies, etc., of various types of metal and wire braided hose.

Dependability...

proven on most diesel makes and models

MAKES **DETROIT** *Vernatherm* Engine Thermostats . . .

The *BEST* Choice For Your Needs

If you're concerned with the design of lubricating oil or cooling systems for jet, heavy-duty gasoline or diesel engines it will pay you to specify DETROIT Vernatherm Engine Thermostats. For only DETROIT Engine Thermostats give you the assurance of dependable, efficient operation performance proven on military and commercial aircraft . . . on ordnance combat vehicles . . . and on most diesel makes and models. So take advantage of this outstanding record—specify DETROIT Vernatherm Engine Thermostats, the true standard of the industry for rugged, exacting service! Available as engine cooling thermostats, oil cooler thermostats, shutter thermostats and thermostatic power elements.

All DETROIT Vernatherm Engine Thermostats are . . .

- *Designed to work with either open or closed cooling systems*
- *Not affected by barometric pressure*
- *Built with tight seats for minimum leakage*
- *Not subject to chatter*

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DETROIT Controls CORP.

DETROIT 8, MICHIGAN Division of American Radiator & Standard Sanitary Corporation

Canadian Representatives in Montreal, Toronto, Winnipeg—Railway & Engineering Specialties, Ltd.

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Get Rid of Dirty Oil . . .
Get Lower Operating Costs,
Longer Equipment Life

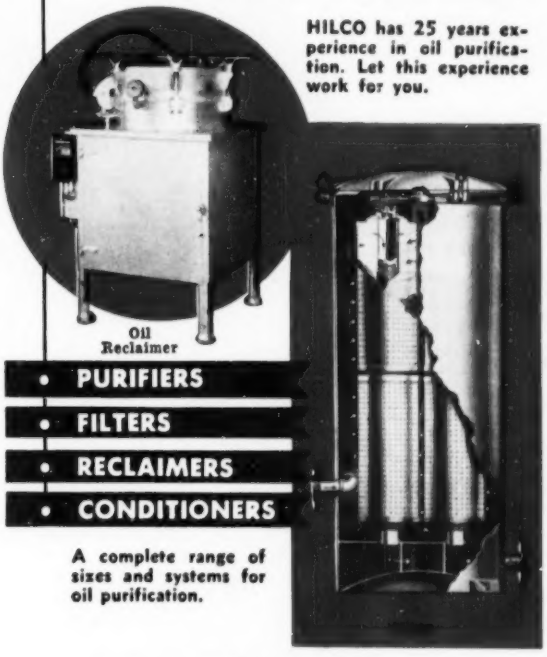
HILCO oil purification means complete oil purification! With a HILCO you get removal of sludge, acids, carbon, water and fuel dilution economically and efficiently. HILCO operation is continuous, all-electric and automatic.

Clean oil at all time reduces down time, increases production and HILCO units pay for themselves in savings.

HILCO offers a wide range of oil purification units . . . one to meet your needs. Write us about your equipment . . . and get recommendations at no obligation.

• *THERE'S A* **HILCO** *FOR EVERY LUBRICATION AND FUEL OIL FILTERING PROBLEM*

HILCO has 25 years experience in oil purification. Let this experience work for you.



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Feeder Voltage Regulators

The installation, operation and maintenance of feeder voltage regulators (Type AFR and DFR) is described in a new manual released by Allis-Chalmers Mfg. Co., General Machinery Div., Milwaukee 1, Wisc.

The manual contains connection and installation diagrams, tables for calculating setting of line drop compensator, maintenance hints, and describes the "Vari-Amp" feature, forced air cooling, and oil-sealed inert gas protection.

Casting Impregnation Story

The developmental and application story of modern impregnation of porous castings is available in an 8-page, 2-color bulletin issued by the American Metaseal Mfg. Corp., 30 E. 60 St., New York 22, N. Y.

Photographs show equipment used in batch immersion for rapid treatment of large quantities of parts as well as applications in various metals. Tables are also provided giving properties of a new Metaseal impregnant and the corrosives it will resist.

Petroleum Measurement Tables

The American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., has just published the "ASTM-IP Petroleum Measurement Tables"- prepared jointly by the Society and the Institute of Petroleum, Great Britain- consisting of a comprehensive group of tables standardized on international basis for calculation of quantities of crude petroleum and petroleum products. Three separate editions, American, British and Metric are available, the result of intensive work begun in 1946.

Tables are provided over normal operating ranges for the reduction of gravity and volume to standard temperature, for calculation of weight-volume relationship, and interconversion of a wide variety of commercially useful units. These tables are expected to apply to crude petroleum regardless of source and to all finished products derived from it regardless of method of manufacture. Tables are printed in large type and an easily-followed example is furnished with each table.

Municipal Power Maintenance

Caterpillar Tractor Co., Peoria, Ill., has produced another cartoon-type instruction booklet, latest of which is "Maintenance Guide". Diesel-electric sets installed in a town's power plant are discussed with a view to proper maintenance. Included are maintenance of fuel system, lubrication system, cooling system, air intake and exhaust systems, generator, and exciter.

Earth Moving Equipment

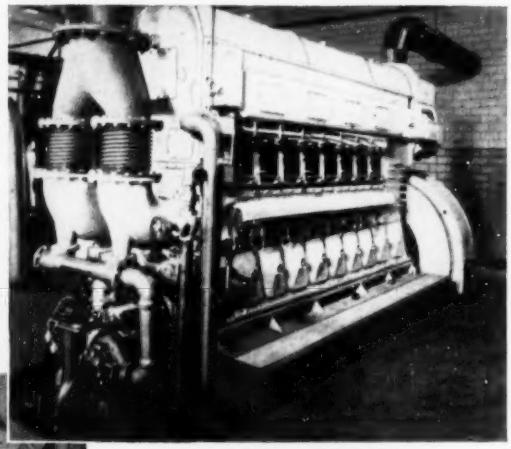
The Euclid Machinery Co., Cleveland 17, Ohio, has issued a new catalog describing its line of equipment powered by GM 2-cycle diesel engines.

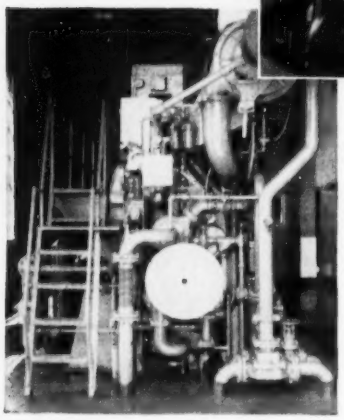
Pictured are heavy duty trucks from 10- to 34-ton capacity, bottom dumps, scrapers and loaders. Illustrations of engine models and cutaway views of the Allison torque converter and torqmatic transmission are also included. Featured for the first time is equipment powered by the GM 275-hp "6-110" diesel. The catalog contains a complete list of the company's distributors and an extensive listing of GM diesel servicing points.

WHENEVER rigid piping or ducts must be connected to engines...

CMH Flexible Metal Hose at work on diesel exhaust connectors on a Fairbanks-Morse engine.

Below — at work as coolant water hose on a Nordberg diesel.





use CMH FLEXIBLE METAL HOSE

CMH Flexible Metal Hose absorbs engine vibration—isolates the forces that damage rigid piping and loosen exhaust, oil, air and fuel connections. It is also the most economical and dependable method of eliminating piping stresses that result from misalignment or expansion and contraction.

CMH Flexible Metal Hose is available in a wide range of types, sizes and assemblies to meet your needs. Distributors are located in all principal centers. See your classified telephone directory or write for the name of the distributor nearest you.

HERE'S YOUR GUIDE TO MOTION CONTROL

For helpful information on motion control, Write for Bulletin 124.

CHICAGO METAL HOSE Division

Flexonics Corporation

1363 S. Third Avenue • Maywood, Illinois

Manufacturers of flexible metal hose and conduit, expansion joints, metallic bellows and assemblies of these components.

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Flexon identifies CMH products that have served industry for over 50 years.

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PREMAX

PRESSURE INDICATOR

for DIRECT-READING OF COMPRESSION AND FIRING PRESSURES

OF EVERY TYPE OF DIESEL ENGINE

ONE OF THE FEATURES Responsible for Its Overwhelming Preference by Leading Diesel Manufacturers and Operators

Successive readings may be taken rapidly since no venting of the instrument is required between readings. No closing of valves required to change from firing pressure to compression pressure reading.

For other features, write for Bulletin 294

- - - ACCURATE PRESSURE READINGS as high as 1700 P.S.I.

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INDUSTRIAL INSTRUMENT CO.

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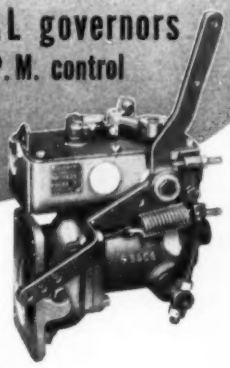
PIERCE

CENTRIFUGAL governors give you exact R.P.M. control .... at LOWER COST



For more than 40 years Pierce has specialized in the speed control field. Pierce Centrifugal Governors, engineered specifically for your Diesels, give accurate, dependable control of engine RPM to meet the varying conditions of any job. Pierce Governors are standard equipment on many of America's finest diesel engines . . . assuring maximum protection, dependable performance—at lower initial and maintenance cost. Replacement governors and parts are available through your local distributor or fuel injection service station.

For distributor's name or information on special governing problems, write

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1614 Ohio Avenue, Anderson, Indiana

"WORLD'S MOST EXPERIENCED GOVERNOR MANUFACTURER"

ACCURATE

Low Cost Temperature Control

for Jacket Water and Lube Oil

POWERS

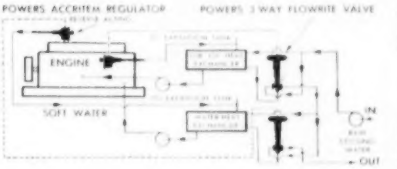
Compressed Air or Water Operated

ACCRITEM REGULATOR

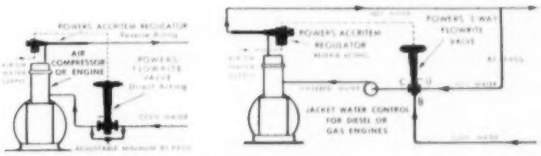
Unsurpassed for reliability and power to operate large or small size 3-way or 2-way diaphragm valves for accurate control of jacket water and lube oil cooling temperatures.

IMPORTANT ADVANTAGES

- ***Adjustable Sensitivity*** and over-heat protection.
- ***Calibrated Dial*** temperature adjustment.
- ***Simple, Rugged Construction*** withstands vibration and insures many years of reliable service.
- ***Temperature Ranges*** 50 to 250° F. and 150 to 550° F.
- ***Easy to Install.*** Requires 15 lb. supply of compressed air or water for its operation.
- ***Small Size*** — regulator head is only 2⅞" x 3⅝", sensitive bulb is 12" long with ½" I.P.S. connection.



Only a few of many possible applications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POWERS FLOWRITE DIAPHRAGM VALVES controlled by Powers ACCRITEM Regulators provide an unbeatable combination for better control and lower maintenance.

Write for Bulletin 316 (a62)

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60 YEARS OF WATER TEMPERATURE CONTROL

Field Notes

Alco Delivers First of 83 Locomotives to Army

Recently, the first of an order for 83 new Alco-GE diesel-electric locomotives were delivered to the Army Transportation Corps. The new 1600-hp units are a military road switching type adapted to operation on any standard or wide gauge track in any climate in the world.

They are comparable in characteristics, speed, and pulling power to the standard 4-motor Alco-GE 1600-hp road switcher, but include several alterations and modifications to meet exacting Army specifications.

To permit operation on various track gauges, trucks are fitted with longer axles so that wheels can be set for the standard American gauge of 56½ inches, or any of the three foreign gauges of 60, 63, or 66 inches. The locomotive is 56¼-ft long, 13½-ft high from the rail, and 9½-ft wide over the grab rails.

Power is supplied by a 1600-hp Alco 12-cyl supercharged engine driving a GE generator and traction motors. Geared for a top speed of 65 mph, it is designed for either freight, passenger or switcher service.

Designs of the new units meet the all-important Army requirements of keeping the weight under 120 tons to conform with load limits of foreign countries. Weight of the standard Alco-GE 6-motor road switcher is 180 tons.

Diesels Speed Canada Freights

Freight schedules of the Canadian National Railway between eastern Canada and the Pacific coast have been speeded up by 20 to 24 hours as a result of dieselization, S. F. Dingle, vice president of operations, disclosed recently. Further improvements in schedules are expected soon when diesel-electric locomotives go on the run between Vancouver and Winnipeg.

New Nordberg Distributor

The Nordberg Mfg. Co. announces the appointment of King-Knight Co., San Francisco, as distributor for its 4FS diesel engines in central and northern California.

ASME Coordinates Lube Activity

Over a period of several years, the lubrication efforts of the American Society of Mechanical Engineers have been reorganized in order to consolidate the lubrication interests of all of the various sections of the Society. As a result of extensive investigation on the practical needs of such a group a format called "Lubrication Activity" was designed and now exists as a subcommittee reporting to the Professional Divisions Committee of the ASME.

An experimental set-up at present, activities of the group have been divided into six parts as follows: research; lubricants; design; builders problems; operators problems; coordination within the Society and with other engineer groups. An additional activity has been proposed to deal with application methods.

A number of projects have already been started, such as the study of the catalytic effect of materials on lubricants and the effect of lubricants on metals, plant training of lubrication personnel, coordination of design data, and fretting corrosion. Liaison has been set up with the American Society for Testing Materials and the American Society of Lubrication Engineers.

Methods Improvement Contest

The Industrial Management Society announces it is now accepting entries for its Third Annual Methods Improvement Contest to be held in conjunction with its 17th National Time and Motion Study and Management Clinic, November 4-6 at the Sheraton Hotel, Chicago.

Student groups studying industrial engineering as well as industrial companies are invited to submit entries. Plaques will be awarded to each classification, educational and industrial, and individuals responsible for the improvements will receive certificates of merit. Rules and regulations may be obtained by writing to the Society, 35 E. Wacker Dr., Chicago 1, Ill.

DEMA Elects Codrington First Honorary Chairman

At a recent meeting of the board of directors of the Diesel Engine Manufacturers Association, Mr. George Codrington was elected to the post of honorary chairman. This is the first time that such action has been taken. It was a tribute given in recognition of Mr. Codrington's many contributions to the diesel industry.

Mr. Codrington practically grew up with the diesel industry and his dynamic personality exerted an influence on it throughout the years. With a background in marine engineering, he joined the Winton Engine Corporation in Cleveland, Ohio as marine superintendent in 1917. He became general manager two years later, a vice president in 1925, and president in 1928.

An immediate objective during this period was to broaden the application of diesels to marine service, both in commercial vessels and large yachts of the time. He was also instrumental in fostering better engines and equipment for such application. Diesel-electric propulsion was a special interest, pioneered as far back as 1919 with Winton equipment installed in the yacht Elfay.

General Motors acquired the Winton interests in 1930 at about the same time that it took over the then independent Electro-Motive Company. Winton's facilities, under Mr. Codrington's management, had helped foster the modern diesel-electric locomotive—first by building gasoline engines, later distillate engines, and finally experimental diesel units for the early Electro-Motive rail cars.

Marine interests were not forgotten and eventually two divisions of GM, Electro-Motive and Cleveland Diesel, evolved. Mr. Codrington was general manager of the latter and became a vice president of GM in 1942. Cleveland Diesel's record, particularly its contribution to the war effort, is well known. Starting in 1932 with a Navy contract for a 12-cyl. 2-cycle, 900-hp diesel designed especially for submarine service, the company went on to power just about everything but capital ships.

Commercial application of Cleveland's products has been equally spectacular, making allowance for the difference in the two types of service. Throughout all these years, Cleveland Diesel and Mr. Codrington were virtually synonymous so closely was his life tied in with that of the company. Eearly this year Mr. Codrington retired, after 36 years with GM.

Among a great many other activities, he served for many years as a director of the Diesel Engine Manufacturers Association. In recognition of this service and his many other con-

here's why it's needed

Overheated jacket cooling water or lubricating oil pressure failure can develop anytime ... and it can happen to the best engine! When this happens, serious engine damage will occur. To prevent such costly damage, engines need the protection given by PENN Safety Controls.

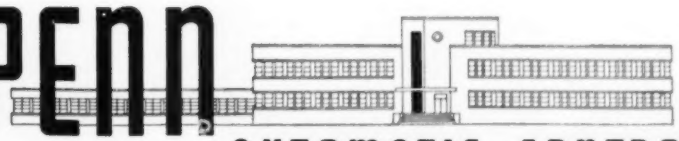
a "MUST" for your engines

here's how it works

If water temperature rises beyond the predetermined safe point ... or if oil pressure falls too low ... the PENN Safety Control goes into action. It automatically sounds an alarm, flashes a warning light or stops engine operation ... whichever you choose. Then, the fault can be investigated and corrected before serious damage develops.

Learn more about this *low-cost* protection for *new and old engines.* Write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U. S. A. In Canada: Penn Controls Limited, Toronto, Ont.

PENN



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

tributions to the diesel industry, DEMA created and elected him to the post of honorary chairman. Upon his retirement, the duties of general manager of Cleveland Diesel passed into the capable hands of Tom E. Hughes. Mr. Hughes has been elected to serve as a DEMA director, representing General Motors Corporation.

NYU Air Pollution Research

The Air and Water Pollution Research Center, College of Engineering Research Div., New York University, is taking a new approach to air pollution research. Rather than preventing any foreign substances from reaching the air, the project is directed toward finding safe, economical and effective means of using air as a repository for waste.

Oil and Gas Engine Power Costs

The latest oil and gas engine power costs, most recent of a series which has been successively issued since 1929 by the Oil and Gas Power Division of the American Society of Mechanical Engineers, has been announced for early publication. Some of the plants to be listed in the new report reveal costs for very extensive periods; for example there are 38 plants reporting costs for 20 years or more.

The report does not restrict itself purely to cost data but includes a wealth of operating information. Most plants have given data permitting the development of Btu's required per kw hr produced, kw hr per gal of lubricating oil, kind of fuel oil burned, identification of major engine repairs effected during the year, cost of repairs sub-divided into material and extra labor above that regularly employed, number and duration of enforced shutdowns, number of regular attendants employed per shift—all of which is valuable data for consulting engineers designing new plants, to cite one field of interest.

Not all plants listed show optimum generation costs. Also included are plants for peak-load duty and standby duty, for either of which the index of the value may be other than mills per kw hr. Indicated is what type of duty each plant is operated on.

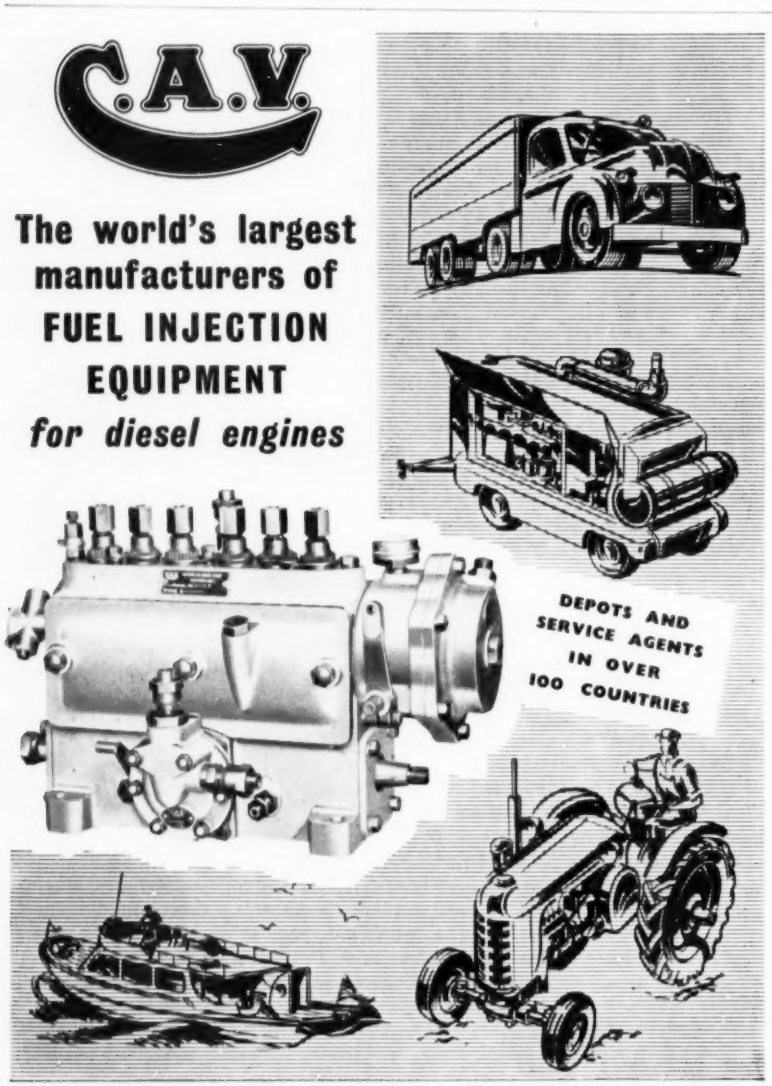
Tabular information is divided into three main tables. Table 1 contains production costs, giving mills per kw hr for certain sub-divisions of total power costs and the total power cost as well. Table 2 lists data by years for plants reporting in previous years. Table 3 compiles operating information reported, as far as possible, by individual engines.

Individual copies sell for $2.50 with a discount offered to those who desire to order in quantity.

Capital Goods Outlook

Industrial expenditures for new capital equipment in 1953 may well reach a record amount. Sustaining factors for this are discussed by the Council for Technological Advancement in an analysis of the current outlook for capital goods markets, recently released.

The Council points out that present anticipated expenditures reflect a strengthening of investment intentions as compared with earlier predictions this year and in the latter part of 1952.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174-607

A joint Commerce Department-SEC survey points to estimated expenditures of $27 billion in 1953 for non-farm plant and equipment, an increase of $500 million over 1952 and $6.4 billion over 1950.

As defense expenditures hit a peak, the years beyond 1953 are foreseen to have a larger proportion of expenditures going into modernization and replacement as contrasted with recent emphasis on expansion. Therefore, the report states, if equipment producers are to maintain an aggregate volume of sales comparable to that since the war, a more rapid rotation of the nation's capital equipment will be necessary.

AIEE To Meet in Atlantic City

An outstanding program covering advances in the electrical field from tiny transistors to gigantic generators will feature the Summer General Meeting of the American Institute of Electrical Engineers at Atlantic City, June 15-19, L. R. Gaty, general chairman, announced. The meeting, which is expected to be the largest summer gathering in the history of the Institute, which has a world-wide membership of more than 45,000, is being arranged by the Philadelphia Section and will mark the celebration of that section's 50th anniversary.

B&O Establishes Diesel School

When the Glenwood back shop of the Baltimore & Ohio Railroad was completely converted from steam to diesel repair, one of the greatest problems encountered was the education of workmen for the job of maintenance. To overcome this a diesel classroom was set up containing a slide projector, blackboard, diagrams and illustrations, and cutaway sections of mechanical parts in the diesel locomotive.

Since forces of the shop were divided into day and night shifts, it was necessary to schedule two classes. The classes were divided into four sections: mechanical on Monday; electrical on Tuesday; pipe and sheet metal on Wednesday; and general on Thursday. Instructors were supervisors. The classes, instituted some time ago, are still going and the quality of workmanship which the men are turning in indicates that the training program is a success.

Kellogg Wins Esso Contract

Esso Standard Oil Co. has awarded a contract for a 60,000 bbl-per-day crude distillation unit at its Bayway, N. J. refinery to The M. W. Kellogg Co., it was recently announced. The unit will be a 3-stage plant similar in design to two now under construction by Kellogg for Esso at its Baton Rouge refinery. Engineering is currently underway, with actual erection scheduled to start in early summer.

Municipal Ups Diesel Purchase

Based on five years of experience with diesel power, the city of Petoskey, Mich., is expanding its diesel electrical power plant to meet growing requirements in the area. Agreement to purchase a 1765-hp turbocharged Superior diesel and 1250-kw GE generator is announced. Space and foundation for this unit was provided for when the plant was built and a removable steel panel wall will simplify installation. Addition of the new unit will increase rated diesel plant capacity to 4250 kw.

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You can't fool us! You're an alert businessman who knows the value of dependable compressed air supply. And Quincy Compressors give years of first-class service because they're ruggedly built for long use.
Depend on a Quincy Compressor specialist to help you select the right compressor for your needs. There are modern, compact Quincy Compressors, a variety of mountings... sizes from 1 to 90 c.f.m. You'll see them all in Quincy's complete line catalog. Write Dept. J-31 for your copy.
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Constant Research—goes on endlessly in Titusville Forge's efficient shops and laboratories—in heat treating methods, in forge and machine shop procedure—in welding—to develop new manufacturing techniques, new cost saving advantages. Let Titusville engineers work with you now—in applying this advanced engineering to your FORGING requirements.

STRUTHERS WELLS
Struthers Wells Corporation
TITUSVILLE FORGE DIVISION
TITUSVILLE, PENNA.

The new unit, of 25 per cent larger capacity than the present three units, will be paid for out of accumulated earnings. Petoskey's power system earned a net of $102,807 in 1952.

Railway Suppliers Convention

The Railway Supply Manufacturers Association plans to hold its 1953 Exhibit and Convention, first since 1947, in Atlantic City from June 22 to 27. A $20 million display will feature everything from locomotives and cars to rail fasteners, with emphasis on the greater efficiency attained in railroad operation in the last five years.

The attendance of key railroad officials from Canada to Chile is said to be insured by the coincidence of the meetings of the Eighth Pan-American Railway Congress, the member roads of the Association of American Railroads, the American Short Line Railroad Association, and the Mechanical, Electrical, and Purchases and Stores Divisions of the AAR.

GE Expands Silicone Plant

Expanded facilities for the manufacture of silicone materials have been completed, at a cost of $5 million, by General Electric Company at its Waterford, N. Y. plant, it was recently announced. Coincident with the expansion, laboratory services have been doubled and employment is up 50 per cent from a year ago.

The basic operation at Waterford is the combining of stable inorganic silicon metal, derived from sand, with flexible organic materials. By varying proportions, chemists are able to turn out scores of seemingly dissimilar products. A new silicone rubber, SE-550, which remains flexible at −120°F has been announced. It is believed to have the lowest change in bending modulus of available elastomer and will have wide application on fuselage equipment for high-flying aircraft as well as for wire insulation on ignition systems of arctic ground equipment.

Diesel Operators Conference

The University of Nebraska is planning to hold its second Diesel Operators Conference on October 15-17. Program of events is still in discussion stage.

Specify THOMAS ALL METAL FLEXIBLE COUPLINGS for Power Transmission to avoid Costly Shut-Downs

DISTINCTIVE ADVANTAGES	
FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
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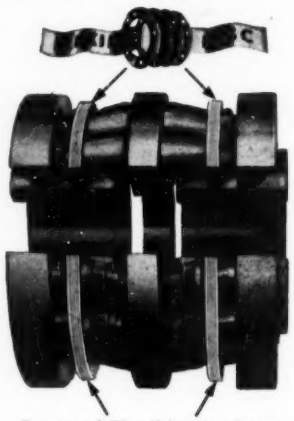
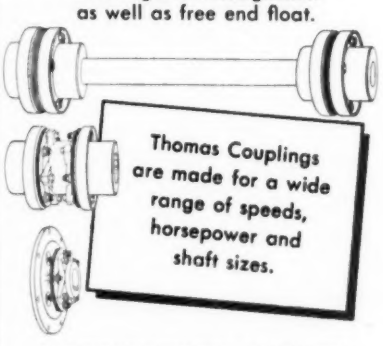
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.



Thomas Couplings are made for a wide range of speeds, horsepower and shaft sizes.

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

NO MAINTENANCE PROBLEMS

ALL PARTS ARE SOLIDLY BOLTED TOGETHER

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THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

More Women in Key Engineering Jobs Near, Worthington Exec

Within the next five to eight years, women must be expected to play increasingly important roles in key engineering and technical capacities, according to J. J. Thompson, manager of the personnel and training division of Worthington Corp.

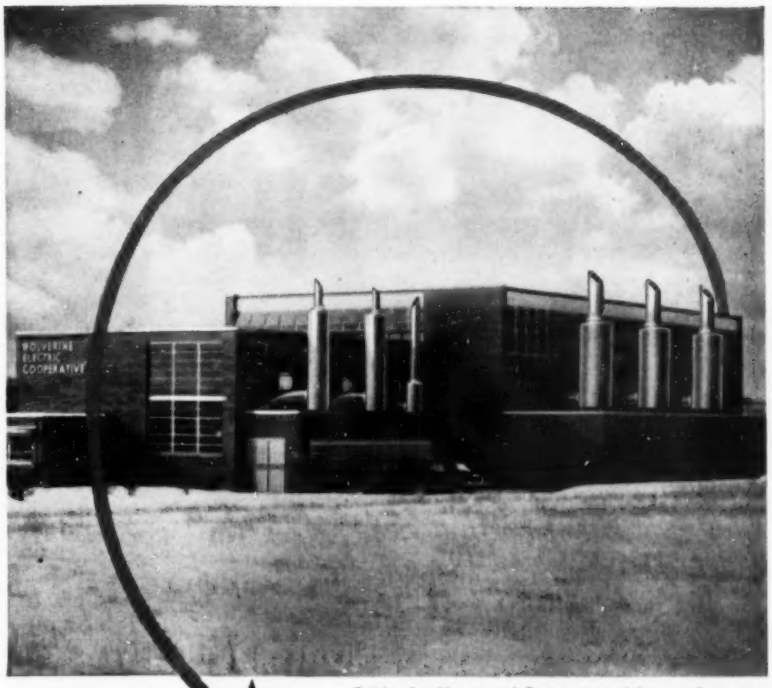
Speaking before top level executives at a national company conference, Mr. Thompson said, "The time has now come when women . . . should seriously consider engineering as a career. Their opportunities for advancing in technical positions are increasing daily and old prejudices due to their sex are rapidly melting." He cited women who have made outstanding contributions in technical endeavors once considered only for men, and several women who have successfully invaded engineering domains in the Worthington organization.

Mr. Thompson quoted from a recent survey estimating the number of graduating engineers in 1953 will be 23,000. Only 14,000 will be available to industry, the rest entering military service. By 1960 the supply will have reached 40,000 but the demand, he predicted, will be greater. "Women will have the opportunity to compete with men."

Great Northern Radio-Equips

Great Northern Railway announces inauguration of a long-range installation program resulting in extensive use of radio in its operation. Included is utilization of very high frequency radio in operation of freight trains and in major switching areas, and augmenting communications when storms or other conditions interfere with wire systems.

First phase involves iron ore transportation on the Mesabi range of northern Minnesota and between there and the railway's ore docks at Superior, Wis. Equipment now being placed in diesel-electric locomotives and cabooses used on ore trains will permit constant radio contact between engineers and conductors, and between them and trackside stations. Eight new diesel-electrics, being delivered for switching and transfer service in the mining areas, will have radio.

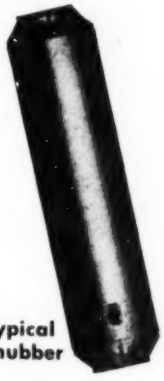


Fairbanks, Morse and Company and Cooper-Bessemer Corporation Diesels, equipped with exhaust Snubbers.

Sound Engineering

by

BURGESS-MANNING COMPANY



*Typical Snubber

. . . wherever the flow of AIR, STEAM, and other GASES create N-O-I-S-E.

Standard Snubber* designs are available, incorporating Air Cleaning, Spark Arresting, Water Separation, Waste Heat Recovery, and Surge Control Features.

You can depend upon Burgess-Manning Engineers for a quality product . . . and SOUND ENGINEERING counsel to solve your noise problems.

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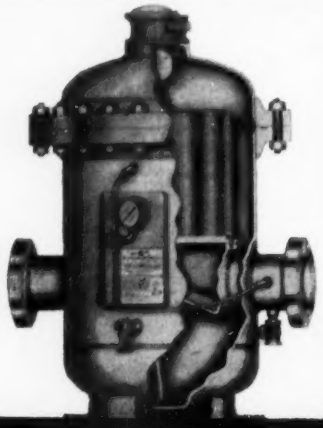

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Designed to remove dirt (down to 5 microns) from diesel fuel . . . removal of this microscopic rouge lengthens the life of diesel engines, pumps, meters, valves, and fittings. They ar compact in size and are built for operating pressures from 0-2500 psi. EXCEL-SO Filters can be built to any code requirement, API-ASMF, ASME or state codes for unfired pressure vessels. They also meet requirements of JAN or MIL specifications. Available in capacities from 10-2000 G.P.M. Many now in use by leading railroads. Special "Throwaway" Plastic Filter Bundle available on request. Write for Bulletin FO-52.

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CRANKSHAFTS - CONNECTING RODS
MACHINE FORGINGS

ELLWOOD CITY, PENNA.

What Do You Know!

(Answers to questions on Page 50)

1. Correct answer is "b". First known example of the principle dates back to Hero of Alexandria, Egypt, in 130 B.C. See article starting on Page 54 for more details.

2. Correct answers are "a" and "d". For a discussion of this phenomena, read the article referred to in the item above.

3. "c" is correct. Although all of the others may be pertinent within the range of operation of a gas turbine, maximum output is basically dependent upon what the materials can stand. See article referred to above.

4. "c" is most correct in the broadest sense. "a" and "b" are factors in achieving "c". For discussion, see the article on Page 44.

5. Correct answer is "b". The various executions possible are discussed in the article on Page 60 and an installation of a dual-fuel model is given on Page 38.

6. Correct answer is "c". Many of the newer engines use the higher supercharging pressures (a) and aftercoolers (b), but (c) is unique to this engine type. See the article on Page 60 for a full explanation.

7. "a" is correct. Not only is the factor of safety important in itself, resulting in lowered insurance costs, but refueling and storing units on the docks improve availability. For details see article on Page 63.

8. "b" is correct. On Page 41, an article appears that describes such an installation and what amounts to practically pushbutton controls that can be remotely operated.

9. Correct answer is "b". While all three are outlined, more leeway can be permitted in "a" and "c" than in the case of "b". For details of this program and its progress, see the article on Page 48.

We are Experts in Re-Manufacturing Injectors!

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GM-71

Exceptionally Attractive Prices
Finest Quality Workmanship

If you are a quantity user of GM 71 Injectors, we can supply remanufactured units to the highest standards, cheaper than you can do them yourselves, whether you use new parts, used parts or any other combinations. Our shop is equipped with the finest precision, checking and gauging equipment that enables us to assure you of an injector that will work 99 times out of 100.
We ship *immediately* from stock. 60-70-80-90 and DF6's available from stock. Exchange size for size.
For small extra charge we will convert any injector from one size to another.
NOTE: Check our repair service on Series 110 injectors, fuel transfer pumps and blowers.

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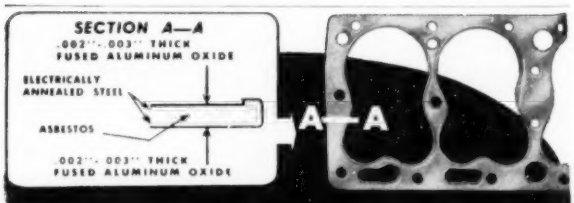
"AMERICA'S FINEST DIESEL COMPONENT REBUILDERS"



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Grease Retainers — Cork Gaskets
FITZ-Rite Treated Fiber Gaskets for oil gasoline and water connections. Complete Sets For Motor Rebuilders.

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SINCE 1906
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There's a Fitzgerald Gasket for every Engine

for DEPENDABLE maneuvering

"You can't beat S-N MARINE GEARS"

That's what Captain Charles H. Cates, owner of the tug Charles H. Cates VII—which has been in continuous service in Vancouver harbor since September, 1949—thinks about the S-N heavy duty **herringbone** reduction gear and **double cone clutch** that transmits power instantly and simplifies maneuvering. "We do a great deal of harbor work", says Captain Cates, "and I would definitely recommend S-N MARINE GEARS for tugs."

S-N Gears are designed specifically for Marine Engines 4 to 1000 H.P. Wide range of reduction gear ratios available.

S-N Manual — Hydraulic — Air Operated Gears

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How often have you looked for the best way to strip paint from metal parts too large to soak in tanks? Or sought the best way when a steam supply is or is not available? What is the cheapest way to strip metal parts in large volume? Or the best way to prepare stripped surfaces for repainting?

Then, too, you may have wanted to know how best to remove oil base paints, synthetic enamels, alkali-resistant plastics, resin based paints, Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics, ureas?

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Organizational News

GM Manager Retires

The retirement of Andrew G. Finigan, a pioneer in the development of the diesel locomotive on American railroads, has been announced by General Motors, Electro-Motive Div.

Andrew G. Finigan

Mr. Finigan began his business career with General Electric in 1906, where he served an an apprentice tool maker and then went to work on gas-electric engines. In 1925 he joined Electro-Motive, assisting in the supervision of car construction. At the time, the company had two gas-electric rail cars in operation, one on the Chicago and Great Western and one running on the Northern Pacific Railroad.

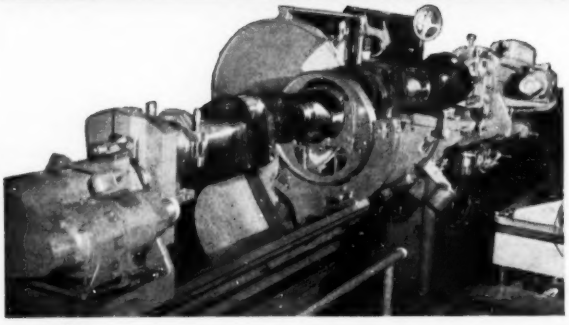
He transferred to LaGrange shortly after the first Electro-Motive plant was completed in 1936 and became general foreman of the locomotive division, advancing to superintendent in 1940. In 1948, he went to Cleveland as manager of the newly acquired Plant Three.

He recalls the first successful diesel-powered streamliner, the Burlington "Pioneer Zephyr", a 3-car train that made history by traveling non-stop from Denver to Chicago in 1934. "Putting the train together was a job", he reminisces, "because the shop had no cranes or headroom. We couldn't even get the trucks under the bodies. We had to move the cars out of the shop on rollers."

Perry Directors Named

At an annual stockholders meeting, D. O. Severson, vice president of the R. M. Hollingshead Corp., was elected to the board of directors of The Perry Co., a wholly-owned subsidiary of Hollingshead. Re-elected to the board were W. H. Lukens, M. M. Perry,

CRANKSHAFT GRINDING SERVICE



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THE LARGEST CRANKSHAFT GRINDING MACHINE IN THE WORLD USED IN AN INDEPENDENT REPAIR SHOP

★ HARD CHROMIUM PLATING SERVICE
★ CRANKSHAFT STRAIGHTENING SERVICE
★ MAGNAFLUX SERVICE

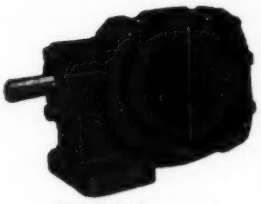
Four machines giving range from the smallest up to crankshafts with stroke of 16" and 200" O.A.L. Complete grinding service for locomotive, stationary, marine, automotive and compressor crankshafts. Undersized journals restored to size by hard chromium plating.

NATIONAL WELDING & GRINDING CO.
2929 CANTON ST. DALLAS 1, TEXAS

Efficient Rotary Geared

PUMPS

500 Series
with Precision Gears
and Needle Bearings



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for DIESELS

It's a smooth flow at high speeds for your diesel lubricating systems when you equip them with these Brown & Sharpe Rotary Geared Pumps. Mechanical seals eliminate leakage problems... no glands to adjust or wear out. Long trouble-free performance has been proved in thousands of diesel installations.

Nos. 53 & 55 are available for pressures up to 200 psi. with capacities from 4 to 34.1 gpm. ***The 500 Series Pumps*** are available in six sizes for pressures up to 500 psi. and with capacities from 5.1 to 37.6 gpm. Write for complete Pump Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

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DIESEL INDICATOR VALVES

KIENE VALVES are designed to give good service under most severe conditions, WILL NOT BLOW OPEN, as valve opens against pressure. The KIENE VALVE HAS EFFECTIVE GAS SEAL when opened or closed, without use of packing or glands.

The KIENE VALVE is SMALL AND RUGGED, 4¼" in length and requiring only 3¼" circle of space for attachment. Has been operated at pressures up to 10,000 psi. ALL KIENE VALVES have standard indicator plug and wing nut connection. Regularly furnished with male ½" NPT engine connection. Other threads furnished on order. Special adaptions for most Diesel locomotive engines.

KIENE DIESEL ACCESSORIES, INC.
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J. A. Vettel, R. LeKashman, P. Jones, and J. J. Laputka.

W. H. Lukens was elected chairman of the board; D. O. Severson, chairman of the executive committee; M. M. Perry, president; R. LeKashman, vice president; J. A. Vettel, vice president and sales manager; J. J. Laputka, treasurer; and, P. Jones, secretary.

F-M's New Engineering Chief

Fairbanks, Morse & Co. announces the appointment of F. F. Kaiser to the post of chief industrial engineer. He will report to the vice president in charge of manufacturing, O. S. Leslie, his duties pertaining to plant layout, plant engineering, tool engineering, etc.

Mr. Kaiser is a graduate mechanical engineer. He joined the company after 25 years of experience in the field of competitive manufacturing. He recently became project engineer at the company's new Kansas City plant and more recently chief layout engineer and chief tool engineer of the Beloit Works, which position he held until his latest appointment.

DeLaval Advancement

The DeLaval Separator Co. announces the appointment of W. F. Schmid to the position of assistant general sales manager. He was formerly manager of the refrigeration division. In his new position he will be closely associated with W. A. McGill, vice president and general sales manager.

Mr. Schmid joined the company in 1932 at its Chicago office. He was engaged in sales management activities until he was called to army duty. After his discharge he returned to the company at Chicago, and in 1943 was transferred to the New York office where he become manager of refrigeration.

F. F. Kaiser

W. F. Schmid

Penn Controls Atlanta Post

Penn Controls, Inc. announces appointment of Harold S. King to manager of its Atlanta district office, replacing F. D. Klein. Atlanta address has been changed to 45 Third St., N.E.

AMF Directors Chosen

Two new members were elected to the board of directors of American Machine & Foundry Co. They are Rodney C. Gott, vice president of the company, and Murray McConnel, president and a director of Cuno Engineering Corp.

Cooper-Bessemer Promotions

Seven promotions to key plant operating positions in its Mount Vernon and Grove City plants have been announced by The Cooper-Bessemer Corp.

Tom McMichan, works manager, and Frank Stevenson, assistant works manager, of the Grove City plant were appointed special assistants to the president with headquarters in Mount Vernon. Mr. McMichan will coordinate tooling and production

methods between the two engine and compressor building plants. Mr. Stevenson, will be responsible for determining what production parts should be manufactured at each plant or purchased from outside sources.

Willard Luli, formerly production manager, has been named works manager at Grove City. Hugh Stevenson, formerly superintendent, becomes assistant works manager. In other promotions made public, Ken Martin becomes production manager; Guy Gahagan, general superintendent; and Clarence Evans, shop superintendent—day shift, at Grove City.

Elliott Elevations

Two recent changes have occurred at the Elliot Company. John W. Anne has been elected a vice president at Jeannette, Pa., and S. W. Crisman has been appointed assistant district manager of the Pittsburgh office.

Mr. Anne has been with the company since 1925, immediately after graduating from Pennsylvania State College. After an apprentice course he was assigned to the condensor department, moving up to manager of that

J. W. Anne

S. W. Crisman

department and later to manager of the heat transfer and turbine sales department. In 1943 he was appointed sales manager of the Jeannette Div.

In 1935, Mr. Crisman came to the company as a graduate from Cornell. He was assigned as field engineer in the Pittsburgh office in 1937 and after a stint in the army rejoined the company in 1945.

Hallett Appointments

Recent personnel changes have been made at the Hallett Mfg. Co. to broaden customer sales service, it was learned.

Robert M. McIntosh has been named vice president and director of sales and Nelson Praigg has been appointed vice president in charge of eastern sales. Further announced was the appointment of Stanley Estes as Detroit resident office manager and Don Foyer as New York district manager. Next step in the company's expansion program is to be the opening of Chicago offices.

Changes at Fairbanks-Morse

At the annual meeting of the shareholders of Fairbanks, Morse & Co., J. A. Cuneo, general sales manager, was elected to the board of directors. At a subsequent meeting, Orren S. Leslie was chosen as vice president in charge of manfacturing and G. J. Malone, formerly controller, was elected vice president—controller.

Mr. Cuneo has been with the organization since 1929, starting as a foreign traveling representative. In 1947, he was appointed manager of the Los Angeles branch and in 1949 became manager of the Chicago branch, advancing to general sales manager two years later.

Mr. Leslie joined the company in 1951 as works manager at Beloit. A year later he was appointed manager

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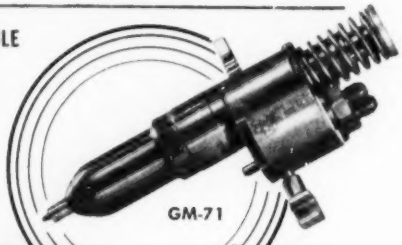

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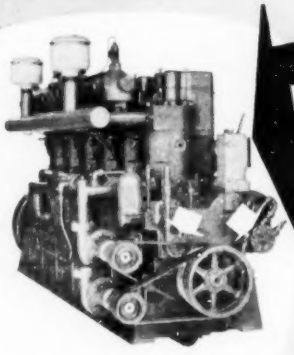

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of manufacturing. Mr. Malone has been with company many years, progressing from the ranks to his present position.

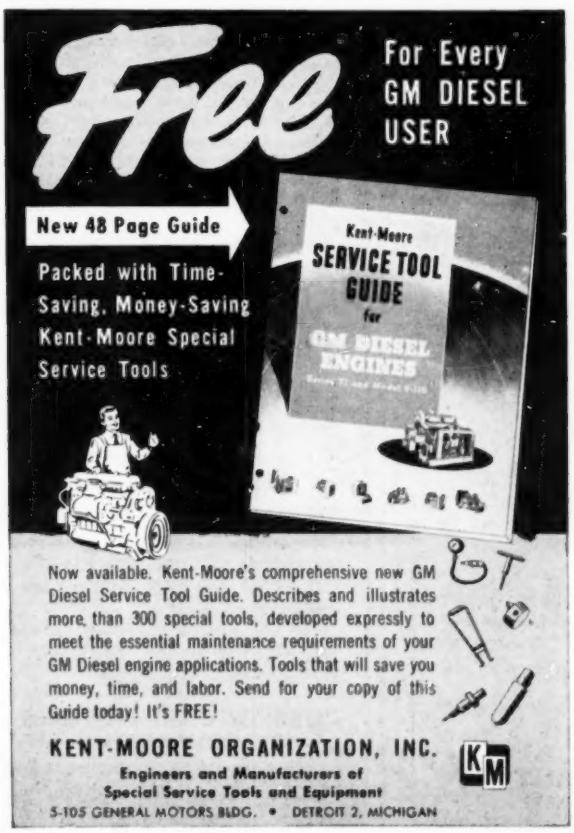
Col. Robert H. Morse, chairman, reported to the shareholders that the company's business is approximately 20 per cent ahead of that for the same period of 1952. "How long this condition will last is something that cannot be predicted," he said. "but we do feel that the future is good."

Rock Island Vice Presidents

The Rock Island Lines announces the election of D. B. Jenks to the newly-created post of executive operating vice president and J. W. Barriger to a vice president.

Mr. Jenks joined the company in 1950 as assistant operating vice president changing from the Chicago & Eastern Illinois Railroad where he had been vice president and general manager. He was named vice president—operations in 1951.

Mr. Barriger started his railroad career as a shop hand for the Pennsylvania Railroad. Following graduation from college he returned there as a rodman in the engineering department and worked in various posts in the operating department. He later worked in investment banking and became president of the Chicago, Indianapolis & Louisville lines in 1946. More recently, he was vice president of the New York, New Haven & Hartford Railroad.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Van Norman Division Managers

The Van Norman Co. announces the appointment of two division managers. Wilbur Hyland assumes his post at Omaha and Norman J. Leary will make his headquarters at Cleveland.

Mr. Hyland, who joined the company in February, has had long experience in the automotive jobbing business, working for 17 years with the Home-Owned Auto Supply Co. Mr. Leary, who joined the company in January, was in business for himself for the past two years. Prior to that and for 21 years he was in the automotive service equipment business.

Vellumoid Elections

Mr. R. D. Seamans was elected chairman of the board of directors of The Vellumoid Co. at its annual stockholders meeting. He has been president since 1944.

Other officers approved at the meeting were as follows: Mr. L. Wald becomes president. He has been vice president and general manager since 1940. Mr. T. G. O'Neil was chosen as vice president. He was appointed general sales manager in 1950. Mr. P. C. Beals was continued as treasurer.

New York Central Reorganizes

Reorganization of the New York Central Railroad's equipment department has been announced. Under the new setup, the department will be decentralized for greater emphasis on car matters and for better fixing of responsibility and authority while simplifying procedures.

Locomotive and car departments will operate independently under general managers of maintenance, with the locomotive division further subdivided into diesel and steam maintenance sections and the car department division divided into passenger and freight car maintenance sections. Two new sections of the department will be created, one consolidating general engineering services and the other merging management services. E. L. Johnson will be chief of engineering services and S. T. Kuhn chief of management services.

One high point will be establishment of the position of industrial engineer under the chief of management services, to be filled by J. J. Wright. This position will entail development of better work standards and methods, the reduction of costs, and development of standards of performance.

Special emphasis will be given to the proper stocking of materials under a supervisor of inventory control, to be filled by C. E. Miller. Provision will be made for recruitment of proper personnel, development of apprentices and the maintenance of an executive development program, under a supervisor of personnel, to be headed by M. S. Riegel. M. T. Bernhofer will be supervisor of budget and statistics.

For the first time a full-time research and development staff will be created. It will work new materials, new applications, and long-range projects such as atomic power, the gas turbine and kindred subjects.

Supervision of the locomotive maintenance program will be directed by A. L. Wright. His counterpart in the car maintenance department will be F. C. Ruskaup. Under Mr. Wright, F. Thomas will become general superintendent and be in charge of diesel and electric locomotive maintenance and C. H. Knowlton will be engineer —locomotive services.

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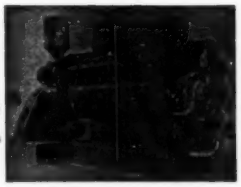

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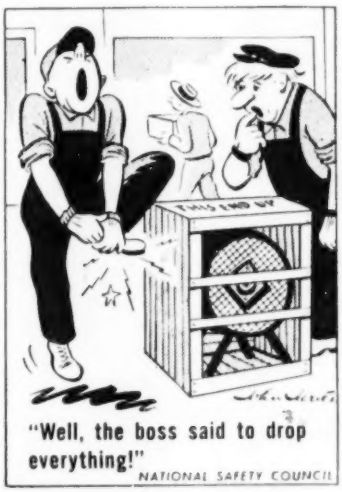
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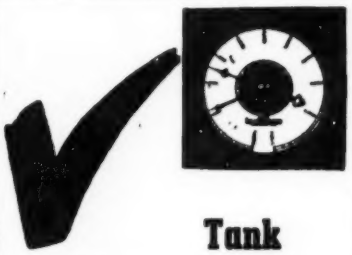

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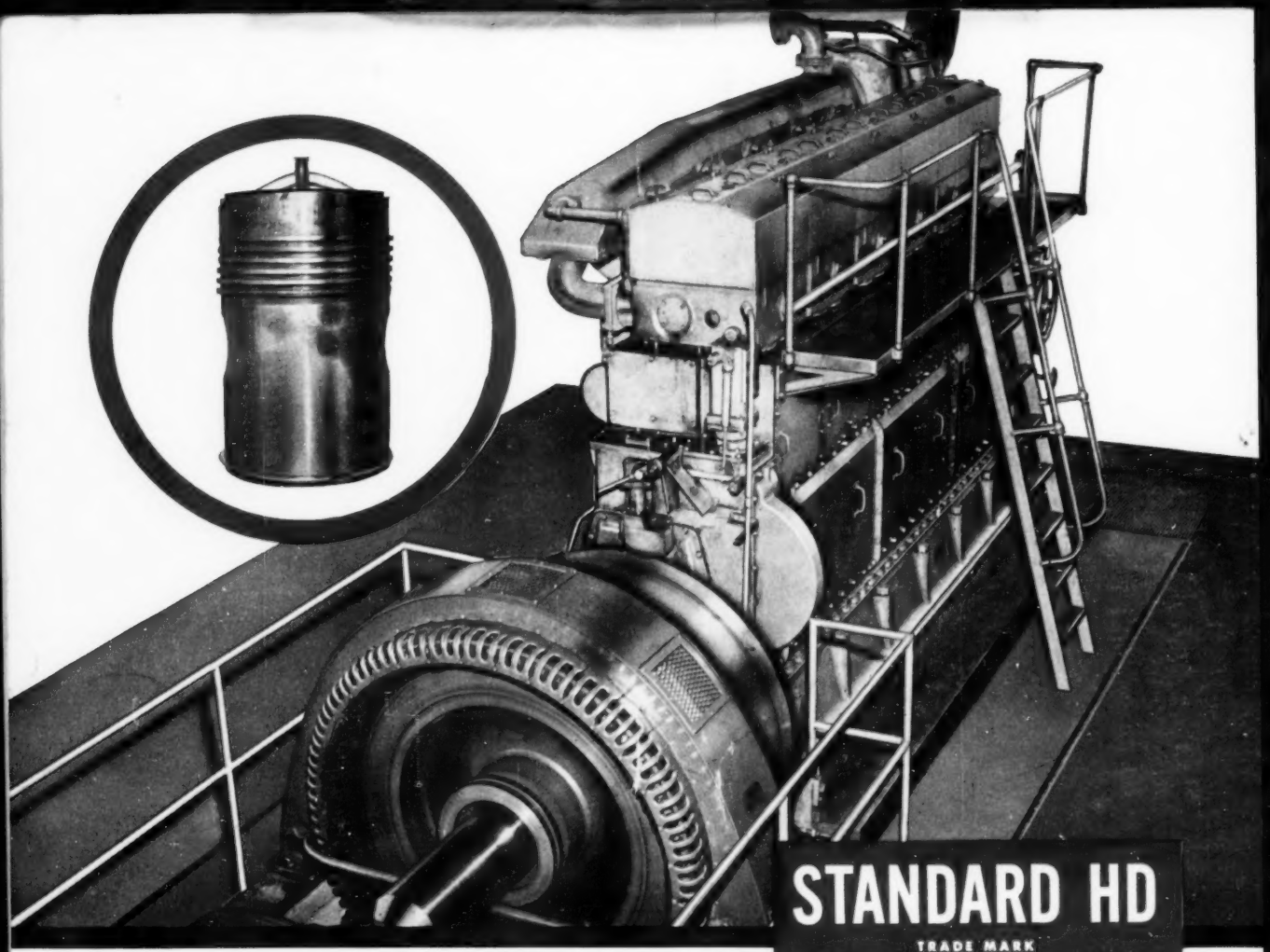

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